PRECISION METAL MOLDING

INCLUDING DIE CASTINGS MAGAZINE

DIE CASTINGS
INVESTMENT CASTINGS
POWDER METALLURGY
PERMANENT MOLD CASTINGS
PLASTER MOLD CASTINGS

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CASTING NEWS NOTES

HOW OFTEN have you been asked to make a decision between the dimensional accuracy and lower finishing costs obtained in a diecasting and the increased strength, pressure tightness and other advantages offered by the permanent mold casting method?

* * *

VERY FEW FOUNDRIES produce both diecastings and permanent mold castings and, as a result, these two methods of casting production are constantly competing with each other. Actually, under unbiased analysis, each method has its own specific applications which should preclude this competition. We, at Monarch, experience this situation constantly. In the long run, proven results usually determine the final answer.

* * *

IF YOU FACE A DECISION between casting methods where physical strengths are an important requirement, do not base your final decision on "book values" on the various types of castings. These charts and tables are written in general terms and, while they can usually be substantiated by test bar results, you may obtain completely different results in the actual casting. We sincerely suggest that you contact producers of several types of castings to determine factually the actual physical characteristics that you will obtain in the specific casting you are discussing. Analyze these factors and endeavor to obtain physical evidence of the actual casting strength you require.

* * *

A THOROUGH ANALYSIS will often bring to light important factors which might otherwise be overlooked. It can also help you to clarify in your own mind the most important requirement in the casting in reference to ultimate strength, yield strength and elongation. You may be asking for a maximum factor in each of these requirements that is impossible to maintain, and may be unwarranted in a factual examination of the requirements that the casting must meet in operation.

* * *

WE HOPE THAT THIS SERIES of comments on castings may have suggested some factors which have been helpful in the purchasing of castings. We are always glad to supply additional material specifically prepared to answer your individual problems. Please feel free to contact MONARCH ALUMINUM MFG. COMPANY, DETROIT AVENUE AT WEST 93rd STREET, CLEVELAND 2, OHIO.

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THE JOB: A die-cast, chrome-plated aluminum salad chopper.

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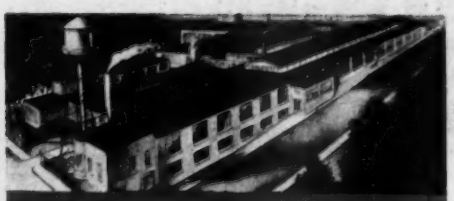

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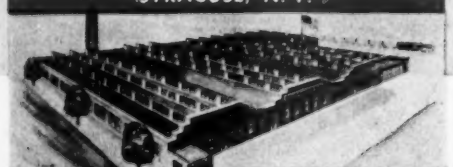

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JANUARY 1953
Vol. 11 No. 1

PRECISION METAL MOLDING

DIE CASTINGS • INVESTMENT CASTINGS • POWDER METALLURGY
PERMANENT MOLD CASTINGS • PLASTER MOLD CASTINGS

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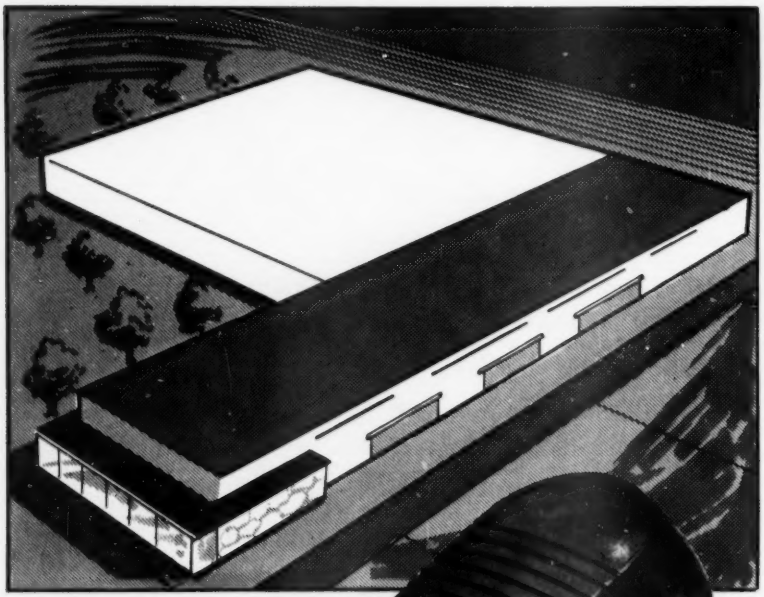

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LETTERS TO THE EDITOR

GOLD PLATED DIE CASTINGS

Will you please send to my attention copies of any articles that you may have on gold plated die castings. We are interested in this process for use on a model plate.—R.H.L.

Several articles have been published in this magazine over the past several years on the application of precious metal plating over zinc base die castings, and the employment of brass plating as a substitute for or simulation of gold. We particularly want to call attention to an article on some interior hardware for a refrigerator presented in April 1951. These zinc die castings have a finish which looks like gold and yet stands up under severe humidity. Copies of articles have been forwarded.—Ed.

INVESTMENT CAST MOLDS

If you have reprints on any articles connected with precision investment casting, kindly mail them and include a bill for the same.

Can you advise us what company is most experienced in investment casting of stainless steel for plastic molds?—J.R.A.

Tear sheets of several pertinent articles have been forwarded, along with names of investment casters who are experienced in casting stainless steel. This process has been used for producing certain difficult cavities for die casting and plastic molding, even though its primary application is for production of machine parts.—Ed.

MORE INFORMATION NEEDED ON INVESTMENT CAST PROPERTIES

For some time I have viewed with interest the many new developments in the field of castings as presented in your

continued on page 6

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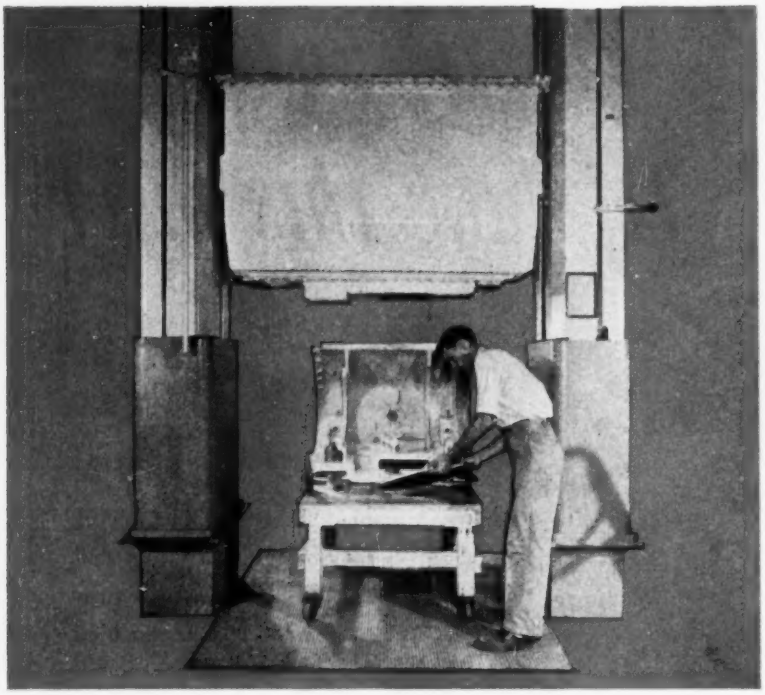

When you are plagued with aluminum casting flaws that show up only after you have done expensive machining, come to Acme Aluminum Alloys. Acme uses X-ray examination two ways: first, to closely control your difficult aluminum casting jobs . . . second, to *prove* casting quality before shipment.

This 400,000 volt radiographic equipment is the larger of two such machines at Acme. Its use on your aluminum castings is insurance against hidden flaws and prevents loss due to machining such castings. It is money well spent where X-ray quality is important and offers your sales department a valuable new sales feature.

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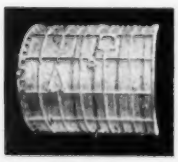
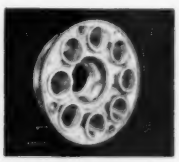


Jet engine housing compressor



Jet engine frame compressor rear

Tank carburetor manifold

Tank transmission case

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LETTERS TO THE EDITOR
continued from page 4

publication, "Precision Metal Molding." I have been particularly interested in the application of steel investment castings to airplanes and helicopters.

Due to extremely close tolerances, smooth surfaces and high strength attainable, steel investment castings appear to offer excellent applications for prototype aircraft where the costs of "hogouts" and forgings are prohibitive.

To date, I have not encountered any articles dealing with high heat treat, fatigue or endurance limits in connection with the above castings. Any information on this subject would be a great boost in the promotion of castings as main structural elements in helicopter rotor systems.—S.T.

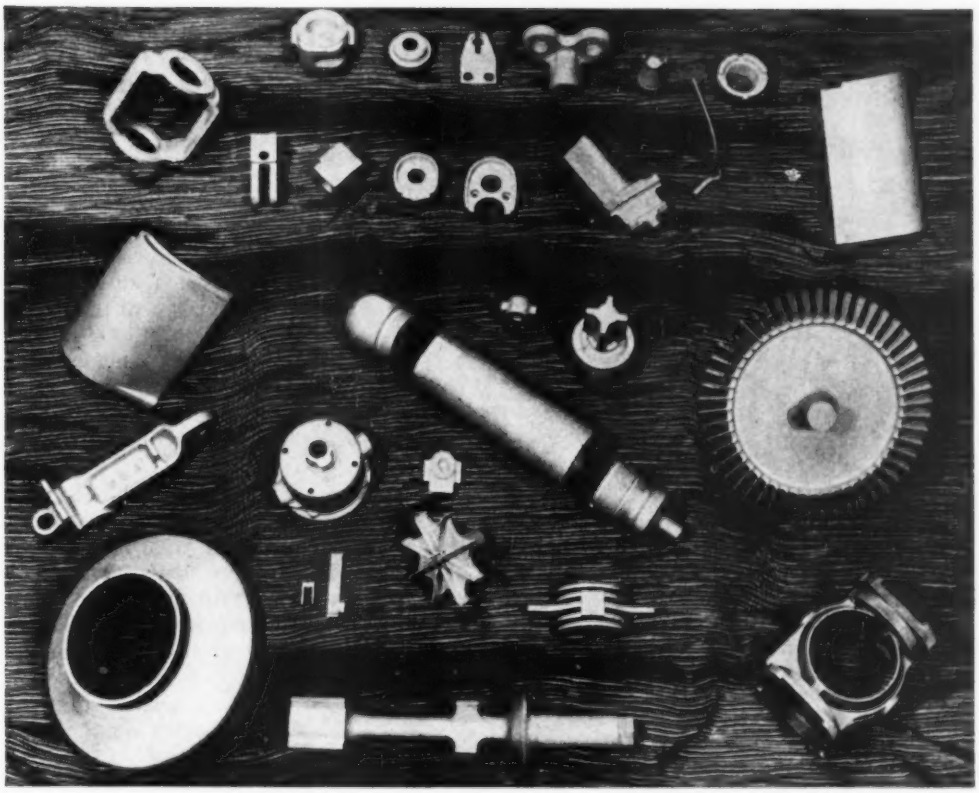
At the present time, not a great deal of data on the properties of investment castings as distinct from other types of castings, is available, but steps are under way to collect and interpret this type of information on an industry-wide basis. As the information becomes known and available, the editors of PMM will keep its readers posted on this vital material. It is felt that as more specific design information of this nature is placed in the hands of design and development engineers, investment castings will achieve a much greater use in all types of industrial, as well as military, production.—Ed

---

ALUMINUM COATING OVER ZINC?

At present we own dies for zinc die-castings that are not suitable to use to produce aluminum die-castings. We are interested, however, in the possibility of applying an aluminum surface to our zinc die-castings

continued on page 67



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With Inco-Cast precision investment castings, others are saving as much as 50 percent of the production cost on small parts.

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Inco-Cast precision castings not only save you money—they make it possible for you to use extra strong and harder alloys for longer service life...

- You can reduce your machine shop bottleneck because they require little or no machining.
- They make possible the use of hard-to-machine metals.
- In many applications you can get parts made by precision casting that would be impossible to make by other methods.
- Frequently it's even possible to simplify your designs when you use precision castings.

If you have a problem with a part whose cost of production seems out of line — if it's a shape where a single casting might eliminate many machining operations — if you have a design that cannot be worked out economically — just send a blueprint or actual sample with an estimate of the quantity needed.

Inco casting specialists will analyze your problem and, if precision casting is a practical solution, they will give you an estimate of costs and their suggestion on the best alloy to use.

In the meantime, for more detailed information about this money-saving process, write for your free copy of "Investment Casting—Its Advantages and Practical Applications."

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ICE HARVESTING SYSTEM

ATLANTIC'S ICE CUTTER CASTING

AN IMPORTANT COMPONENT of York Corporation's most recent development, the York-Flakice Automatic Ice Maker, is Atlantic's ice cutter casting. It cuts the ice into curved flakes... so delicate they will not damage or puncture delicate rose petals.

YORK'S ORIGINAL CONCEPTION of the ice cutter... a vital part of the ice harvesting system ...consisted of three stainless steel parts which had not only to be machined, but welded together.

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York will testify that Atlantic's all-in-one-piece ice cutter casting surpassed all requirements for high physical values, closely-held tolerances, satin-smooth finish, fine-grained structure, clean-cut surfaces... and afforded them substantial savings over former costs.

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Between The Lines

in this and coming issues of PMM

• TRICKY LUBRICATION problems often confront machine designers. This sometimes involves getting lubrication to a hard-to-reach surface. If you have never thought of punching a wick out of a sheet of sintered, porous metal, then read the article beginning on page 26. It may suggest a new solution to some lubricating job.

• MANY QUESTIONS have been received about shell molding. To clarify this, the editors of PMM have asked two metallurgists from Watertown Arsenal to prepare a resume of the process, and some comments on where it can be expected to fit into the precision casting field. Article begins on page 28.

• CAN SINTERINGS be plated? The inherent porosity of this type of metal structure seems to prevent it. An article suggesting a method for preparing sinterings so that they can be electroplated begins on page 47.

• OIL SEALS are universally-used machine components. There are many ways of producing them, depending upon requirements. How one company does a successful job of producing oil seals from zinc die castings to which are bonded rubber or leather, is told beginning on page 25.

• WHAT IS the unit strip system? Few designers or purchasing agents know. Yet it provides some unique advantages for both in buying plaster mold castings. A description of the unit strip and its advantages starts on page 40.

• A REVIEW of powder metallurgy presses is presented as a special technical report in this issue. A tabulation of press features and capacities will be a valuable addition to your file. It begins on page 80.

aircraft component steel parts made from ACCUMET PRECISION INVESTMENT CASTINGS

The pictured castings are currently being used to produce such important aircraft accessories as fuel injectors and regulators, carburetors, landing gear door latch mechanisms, rocket release mechanisms and radar equipment. Cast to close tolerances with smooth surface finish, expensive machining operations are avoided—resulting in saving of valuable time, reduction in cost and eliminating the need for hard-to-get machine tools. Also *Accumet Precision Investment Castings* permit the use of higher alloyed steels that are difficult or impossible to machine or forge, thus increasing the life or performance of the component parts.

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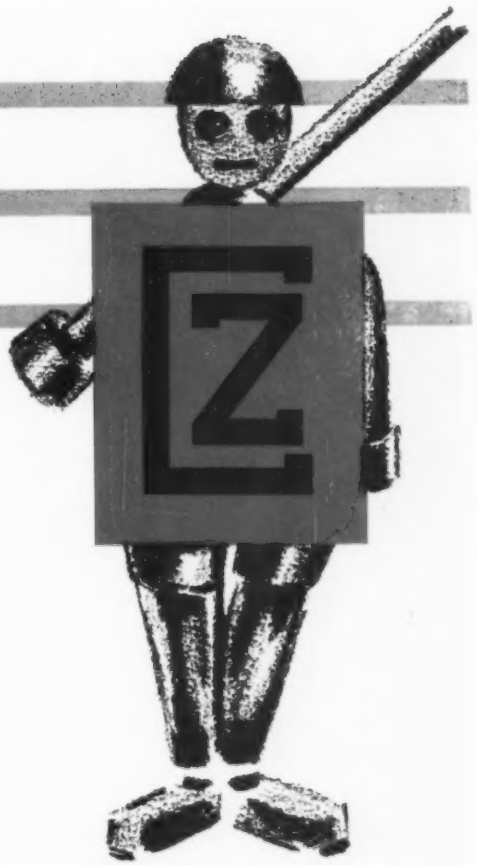

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At no extra cost, you enlist the services of an extra guardian when you have your die castings made by one of the listed die casters, licensed CZ producers.

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In Operation at Montrose Division,

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Photo shows installation of AJAXOMATIC Combined Holding Furnace and Automatic Pouring Unit in connection with die casting machine. In circle at right is shown a closer view of the spout from which uniform shots of molten aluminum alloy are ejected at exact time intervals.

NOW completely automatic die casting of aluminum alloys is possible in smaller quantities than formerly, and at reduced cost. This fact should be of special interest to the manufacturer who has die casting machines in operation and is doing hand ladling. The unit is entirely sealed, the operator feels no heat, accident hazard is eliminated.

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For further information send for descriptive folder A-3

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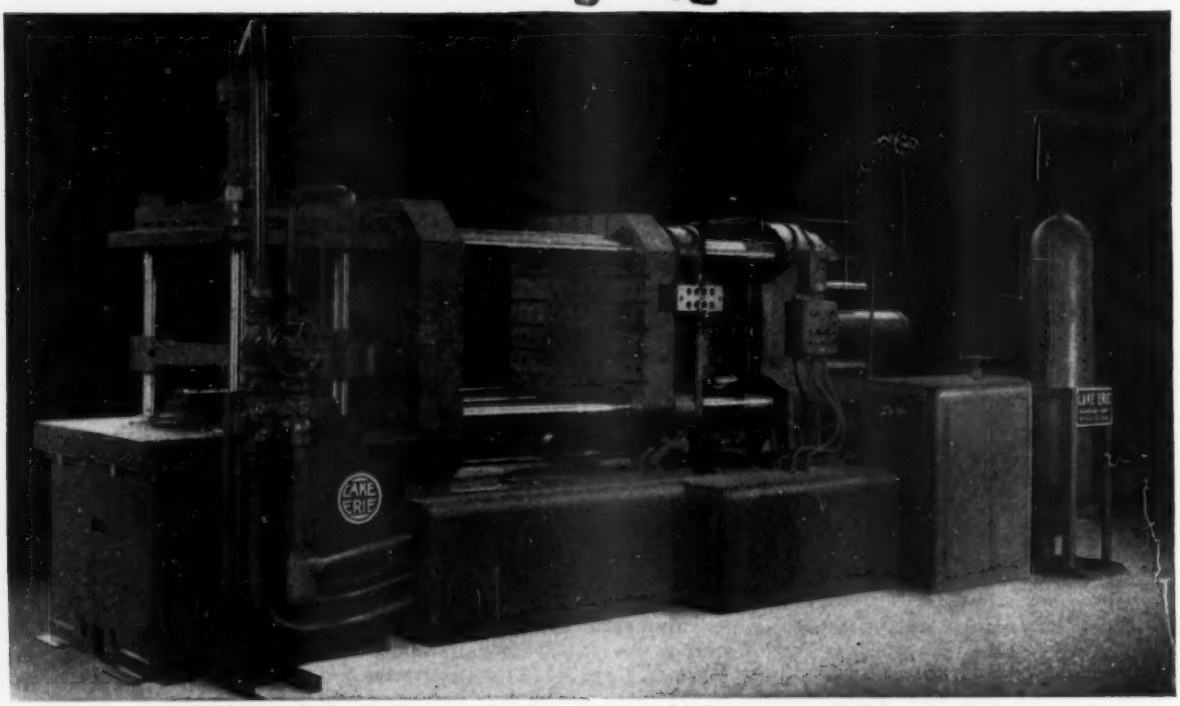

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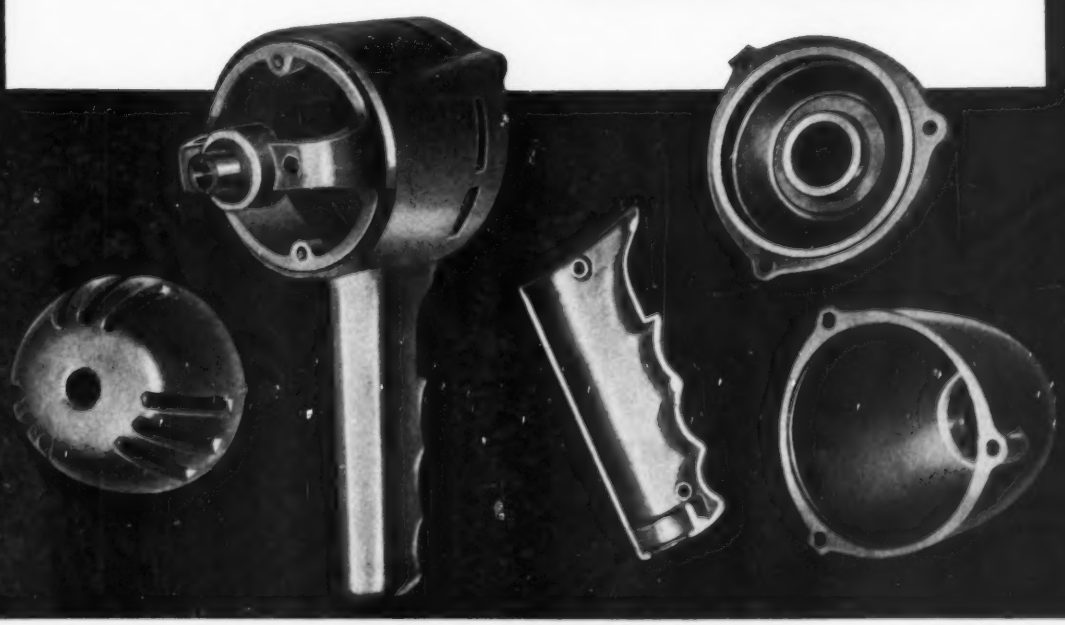

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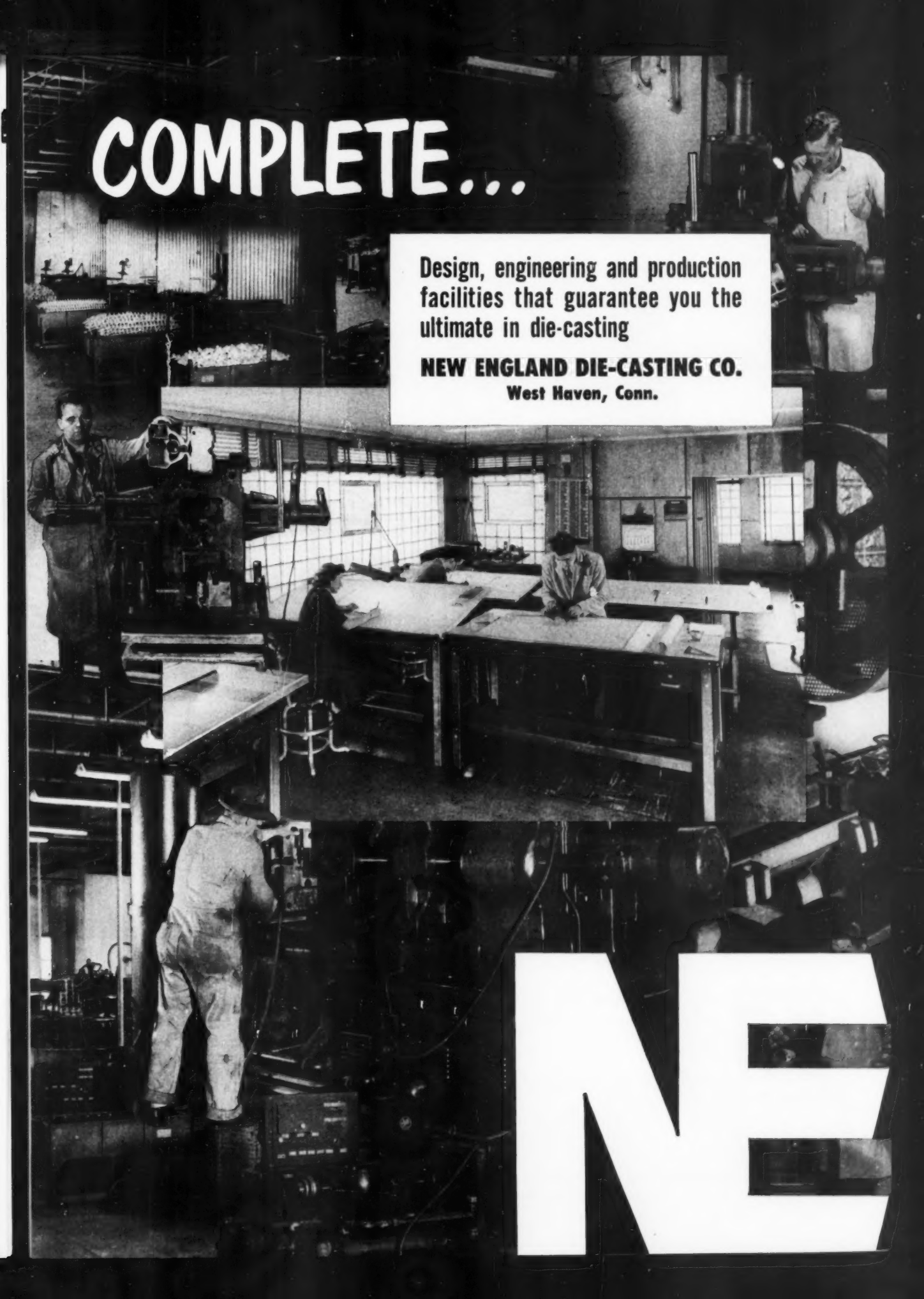
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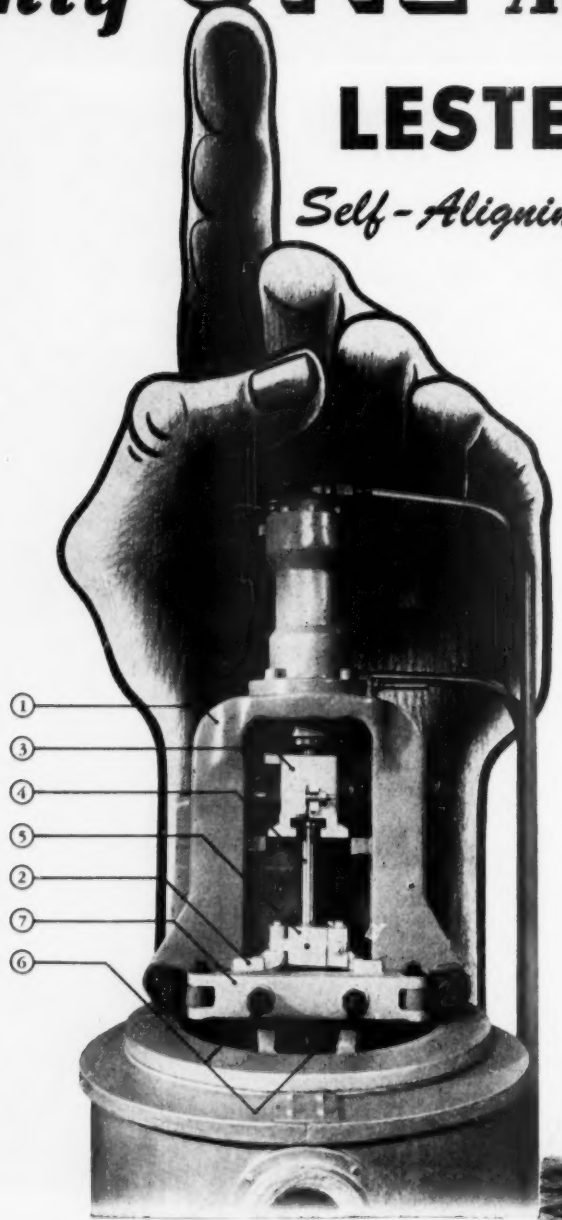

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The only adjustment required is turning the two adjusting screws (6) in the lock bracket (7) to set the nozzle firmly in the sprue bushing. The plunger tip is heat treated steel protected with piston rings. And, since the injection oil cylinder is stationary, all pressure pipe lines are rigid, extra-heavy steel pipe for safety.

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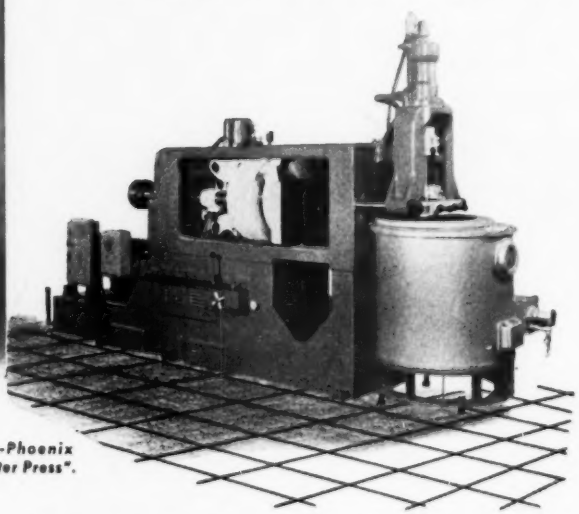

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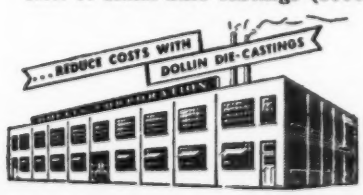

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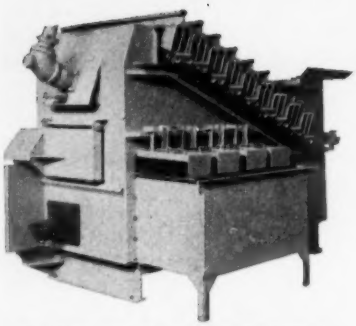
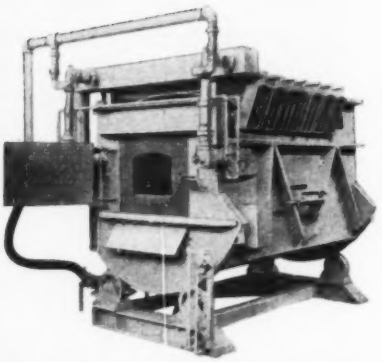


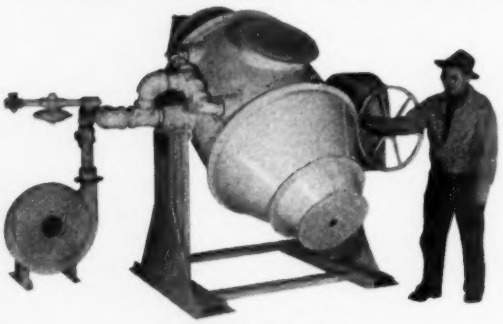
MODEL "MC" DIP-OUT TYPE

For melting and holding all in the same furnace. Hot metal always available. No iron pots or crucibles to replace. Capacities from 500 to 3000 pounds aluminum.



MODEL "SW"—TILTING TYPE

Excellent to run back returns along with ingot required for permanent mold, die or sand casting operations. Also an ideal breakdown furnace. Capacities—600-1000-1700-3000 lbs. Aluminum.



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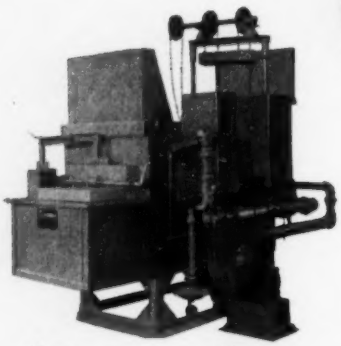

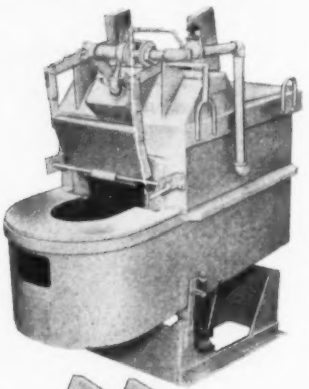

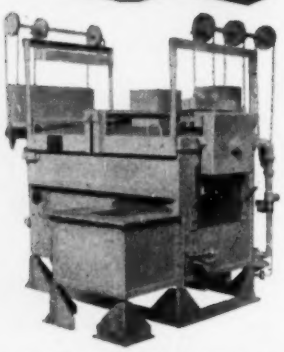

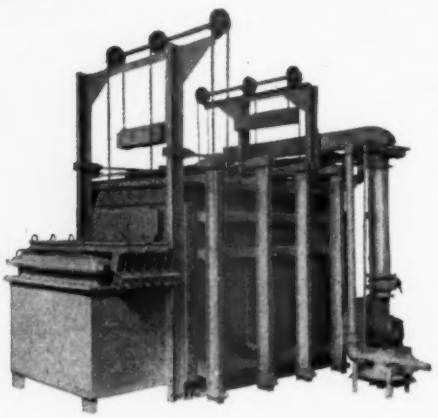

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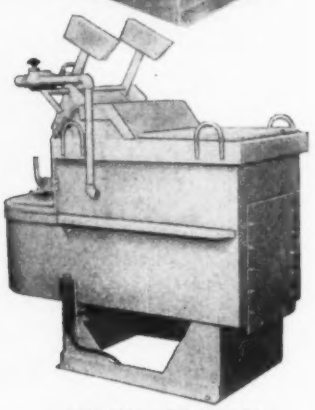

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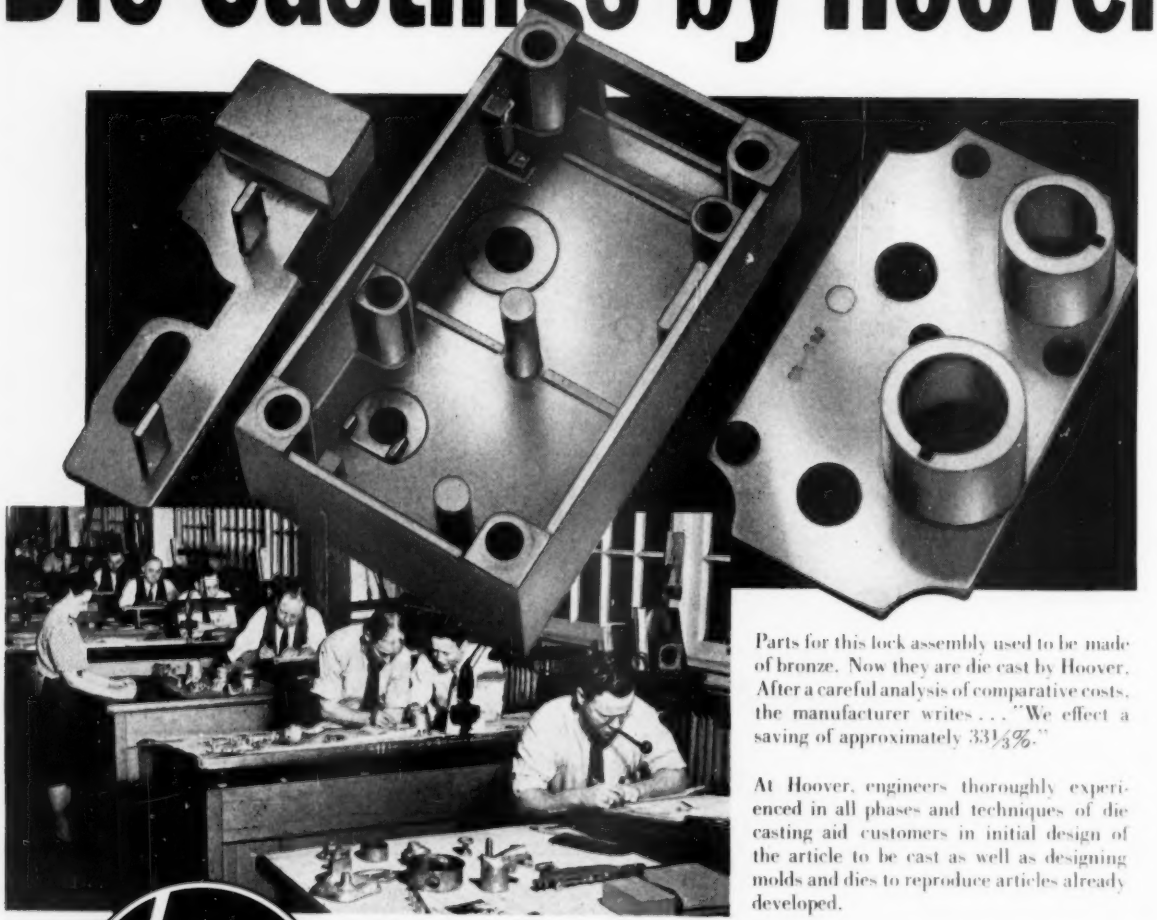
Lock manufacturer finds key to 33⅓% cost reduction in

Die Castings by Hoover



Parts for this lock assembly used to be made of bronze. Now they are die cast by Hoover. After a careful analysis of comparative costs, the manufacturer writes . . . "We effect a saving of approximately 33⅓%."

At Hoover, engineers thoroughly experienced in all phases and techniques of die casting aid customers in initial design of the article to be cast as well as designing molds and dies to reproduce articles already developed.

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WITHIN the limitations of strength and wear resistance, die castings can often be used profitably in the design of oil seals. The ability of zinc die castings to be bonded permanently to rubber, leather and some other similar materials makes their use particularly advantageous.

Rubber and leather can be bonded to DIE CASTINGS for oil seals

" . . . a good mechanical bond that will retain oil and grease is all that is needed . . . "

AT Chicago Rawhide Mfg. Co. three general methods of bonding rubber and leather to zinc die castings are used. A portion of a flat seal together with the casting ready to have the rubber applied is shown at the left. For this type, the zinc die casting is made with a series of steps which act as an anchoring means for the synthetic rubber.

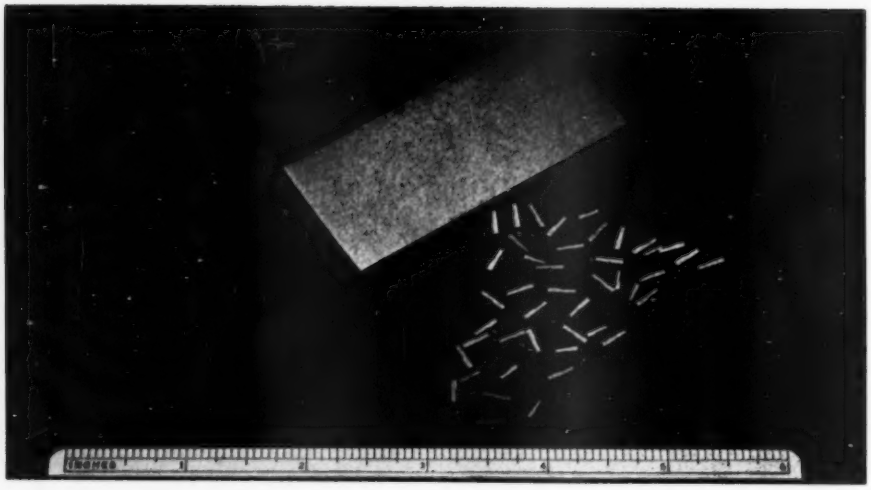
The steel center ring, a rubber preform and the die casting are assembled on a jig and the entire assembly then subjected to heat and pressure. Under these conditions, the rubber is softened and pressed firmly into place. After curing, the rubber is permanently bonded to both the zinc and to the steel.

In addition to forming the anchoring grooves in the die casting, the foundry is required to hold the casting to rather close dimensional tolerancess. The bore is critical since the fit on the vulcanizing jig must be close to prevent the formation of a flash of rubber. Since the part mates with others on both the flat surfaces, both flatness of the faces and parallelism of them to each other are important. In most cases, the foundry is able to meet all of the requirements. Occasionally, the bore of the ring must be machined to secure the desired fit.

The seal, of which the part illustrated is a portion operates at atmospheric pressure on both sides so that pressure tightness is not a problem. The bond between the metal and the rubber need only be tight enough to prevent leakage of oil and grease.

Another type of oil seal is also shown. In this unit, the advantages of die casting are more fully utilized. All of the necessary

continued on page 77



"Pinpoint" lubrication

By CHARLES FILLINGER*

The design of what might be termed "pinpoint" lubrication can at times present a major problem. Where uniformly distributed films of oil must be applied to an area that is very large when compared with the area of application; where essentially zero pressure drop across the oil channel exists; where felt wicks do not have the desired wear characteristics; and where excessive amounts of oil can ruin a product or insufficient amounts of oil can ruin a machine; then a real problem in lubricant applicant exists.

For conditions such as those noted above or similar ones, there exists a material that will, in many cases, be a complete and highly successful solution. Porous bronze, impregnated with oil, similar to the well-known porous bronze bearings, is available in sheet form from which bronze lubricating wicks can be fabricated. The sheet stock is available in a wide range of sheet sizes up to a maximum of about 8 x 36 inches and in varying thicknesses from 0.023 to 0.062. Porosity ranges from 25 to 30 percent.

This sheet stock can be sheared, punched, bent and otherwise formed by standard procedures except those requiring appreciable tensile strength and ductility such as deep drawing. A sheet of 0.023 thick material and some tiny oil wicks made from it by stamping is shown above.

To illustrate the applicability of this sheet material, one typical use of it will be described.

In the textile machine industry, parts often move at very high speed and must be adequately lubricated. At the same time, if excessive lubricant is present, it can ruin large quantities of the product being made. Spinning rings with their associated travelers are such an application.

These rings, in one of several designs, are used on all machines that twist a plurality of fine threads into a single heavier thread or yarn. As an initial step, the number of threads to be twisted are grouped together and given a slight twist as they are wound on a bobbin. As a second step, the lightly twisted thread is removed from the bobbin and tightly twisted to form the finished thread or yarn. This second step makes use of the ring and traveler mentioned.

Since the ring is stationary and the traveler rotates on it at speeds up to 15,000 rpm, it is essential that adequate lubrication on the ring be provided. At the same time, excess oil can easily stain large quantities of thread while insufficient oil will cause excessive wear and frequent breakage of the thread. A nice balance is, therefore, necessary to prevent uneconomical operation.

In the spinning ring made by the Herr Mfg.

---

*Chief Engineer, Herr Mfg. Co.

Sheets of sintered porous metal can be used to punch, shear or bend special shapes which solve unusual lubricating problems. How a punched bronze wick solved a high speed lubrication problem for the manufacturer of a textile machine is discussed below.

. . . by POWDER METALLURGY

Co., Inc. of Buffalo, N. Y., it was found that oil had to be applied to two surfaces of the ring to secure the amount of lubrication that was most desirable. Earlier models of the spinning ring had used felt wicks to carry oil to the ring surface where it was distributed by the movement of the traveler. This method of moving the oil to the surface was satisfactory as long as the wick did not wear down or did not pull out. Life was quite short, however, due to both of these factors.

The oil transport system was, therefore, redesigned. To carry oil to the inner surface, the wick hole was enlarged and a porous bushing inserted in the hole. The wick was then threaded through the hole in the bushing. When excessive wear of the wick occurred, oil was still distributed to the surface by the porous bushing. This change helped, but did not eliminate the possibility of the wick pulling out.

To correct the pulling of the wick and, at the same time, to carry oil to the top surface of the ring, a hole was drilled through the ring and bushing. One of the little fork-shaped pieces of porous bronze made from sheet stock (Figure 1) with a small felt wick threaded through the fork and up both sides was then forced into the hole in such a manner that the fork straddled the wick running through the bushing. This scheme effectively locked both wicks in place and provided porous bronze members to carry oil if the wicks wore to the point where they were no longer serviceable.

One of the rings with both the bushing and the forked wedge in place is shown above right. Depending upon the size and design of the particular ring, the number of points where oil is applied to the surfaces varies from two up.

Along with the redesign of the oil transfer method, the holder for the spinning ring was redesigned. In older models, this holder was

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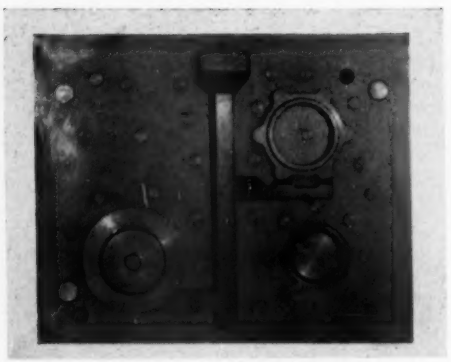
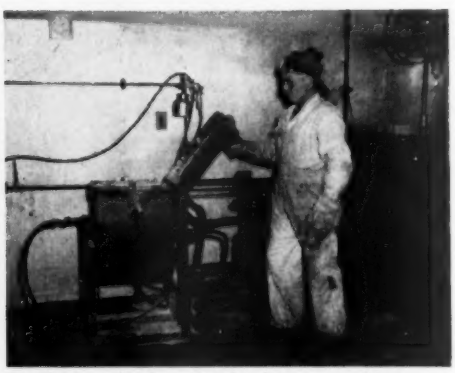


1. Match plate for small castings.

2. Match plate and shell halves for steel clevis.

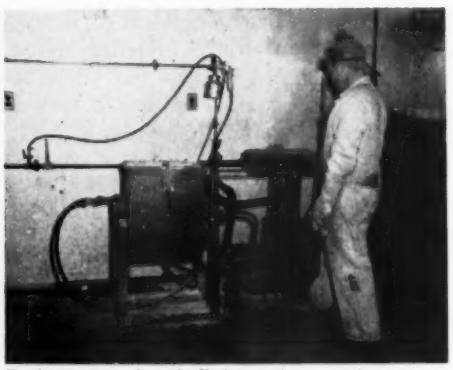


3. Placing the hot match plate in position.

4. Clamping the match plate securely.

5. Dumping sand-resin mix on match plate.

6. Placing shell and match plate in oven.



7. Stripping the shell from the match pate.

8. Complete shell mold.

SHELL MOLDING . . . What is it? Where is it used?

By
J. F. WALLACE and I. BERMAN*

DEVELOPMENT of the new shell molding process for small and medium size ferrous and non-ferrous castings has been one of the major technological advancements in the foundry field in recent years This process is able to produce high quality, closely dimensioned, ferrous and non-ferrous castings at a low cost within certain quantity, design, and size limitations. This method (also known as the "C" process after the inventor, Johannes Croning) has been developed very rapidly in the United States since World War II and is now being employed on either a production or development basis by scores of foundries. Some articles [1, 2, 3, 4, 5, 6] have appeared in the technical literature describing the special features, advantages, and quality of castings produced by this process since the publication of FIAT Report 11687 in 1947 invoked initial interest. Unfortunately, however, patent difficulties and the desire for secrecy in some quarters have reduced the number of these publications.

The first and most expensive requirement for the manufacture of a shell mold is the machining of a suitable match plate. This plate is machined from brass, aluminum, cast iron, or steel but, from a dimensional, surface, and durability standpoint, a gray cast iron containing 3.5 to 3.8 percent carbon is preferable. The match plate contains the metal half-patterns of the casting, sprues, runners, guide pins, alignment dowels, and ejection pins, all very accurately mounted. The beveled bosses and corresponding holes are placed in the plate to arrange for accurate registration of the mold halves so that misalignment will be eliminated.

A close-up photograph of a match plate for two small steel castings is shown in Figure 1. Figure 2 shows pictures of a match plate and two shell mold halves for a small clevis steel casting. The guide pins, alignment dowels, sprue, runner, and gating systems can be observed in each figure.

The match plate is heated to 600 F., clamped onto a dump box, and the dump box is reversed allowing a dry mix of 95 percent fine sand and 5 percent phenolic resin binder to cover the hot plate surface. The placing of the hot match plate into position, clamping, and dumping operations are shown in Figures 3, 4, and 5 respectively. During this period of contact with the hot match plate, the phenolic resin softens and binds the grains of sand to form a solid mass.

When the dump box is reversed again, a shell of partially bonded sand remains attached to the plate while the bulk of the sand-resin mix falls away. The match plate (with shell attached) is then introduced into the oven for a final curing period of approximately two minutes.

After curing the shell, the mold is stripped from the match plate and permitted to cool. The placing of the shell and match plate into the oven and stripping operations are shown in Figures 6 and 7. A second half of the shell mold is then produced in a similar manner. The two halves are fastened together by paste and bolts or by application of adhesive tape (using the alignment pins for registration). A completed shell mold is shown in Figure 8.

The shell molds are then arranged in containers for pouring with a backing material of metal shot, metal grit, or coarse sand as demonstrated in Figure 9. The molten metal is poured into the pouring cup molded at the top of the sprue in the shell mold.

The high permeability of the shell mold eliminates the necessity for vents and assures excellent detail with the proper pouring temperature. Melting

continued next page

*Metallurgists, Watertown Arsenal

9. Backing up the shell mold.

pouring temperature. Pouring and pouring procedures are similar to those for small sand castings. The shell molds are removed from the back-up material and the castings shaken out. The castings are cleaned and heat treated by conventional means.

Metallurgical and design considerations

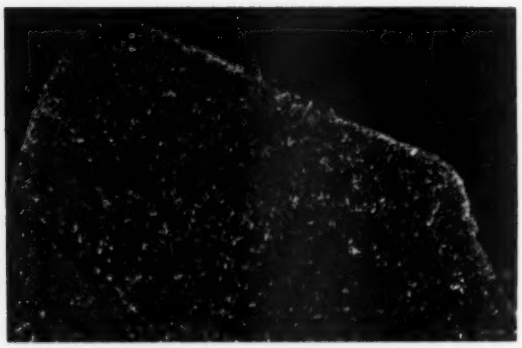
The shell molding process is capable of producing high quality, radiographically sound castings of both ferrous and non-ferrous metals. It is necessary, however, to use established gating and risering techniques to ensure this high quality. The rules of directional solidification and the necessity for bottom gates to avoid mold erosion and dross in non-ferrous castings, still apply.

Shell molds exhibit a much higher permeability and somewhat slower solidification rate than conventional sand castings so that an increased yield can frequently be obtained over sand molding practice and still obtain radiographically sound castings.

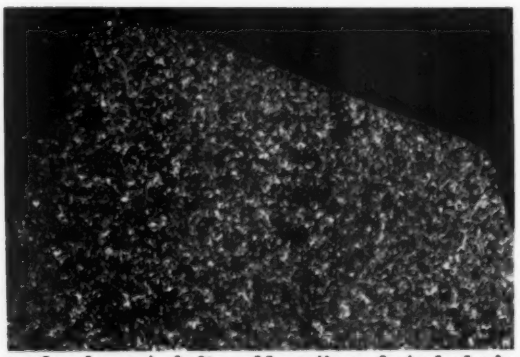
The more rapid solidification rate of conventional sand castings over shell mold castings has been reported previously[6] for non-ferrous metals; the same effect and resulting larger as-cast grain size of the shell mold was observed by the authors for steel castings. This difference in grain size is shown by the macrographs of sections of a clevis casting in Figure 10. It has also been noted that there is little difference in the grain size of steel shell mold castings whether the mold was backed with metal shot, metal grit, or coarse sand. The slightly faster solidification rate of the shot-backed castings over the sand-backed castings is shown by the finer grain size of the former in the macrographs in Figure 11.

The mechanical properties of the steel shell mold castings are similar to those obtained with

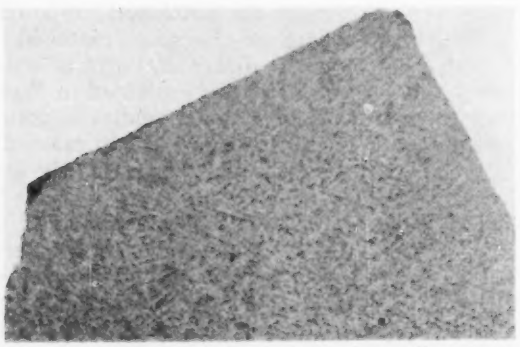
continued on page 68



10a. As cast conventional sand casting of steel clevis; grain size smaller than shell mold casting. 5X



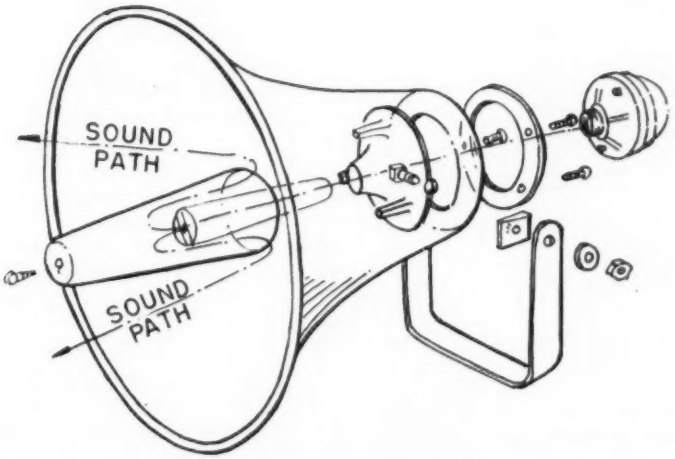
10b. As cast shell mold casting of steel clevis; grain size developed is slightly larger than sand casting. 5X



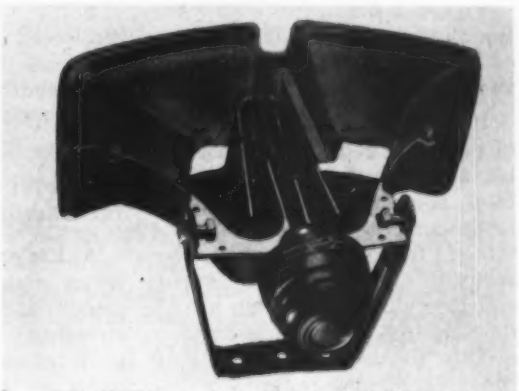
11a. Macrograph of steel clevis casting from shell mold backed by sand. 5X

11b. Macrograph of steel clevis casting from shell mold backed by steel shot. 5X

Mated DIE CASTINGS form Complex Internal Chamber



1. CONVENTIONAL DESIGN of loudspeaker horn calls for a large number of parts assembled concentrically, with all linear spacing accurately maintained.



2. BY REDESIGNING to use die castings, the entire structure is now made up of two basic parts, identical, symmetrical die castings. Note the rectangular cross sectional shape for improved performance.

By MICHAEL M. CONDON*

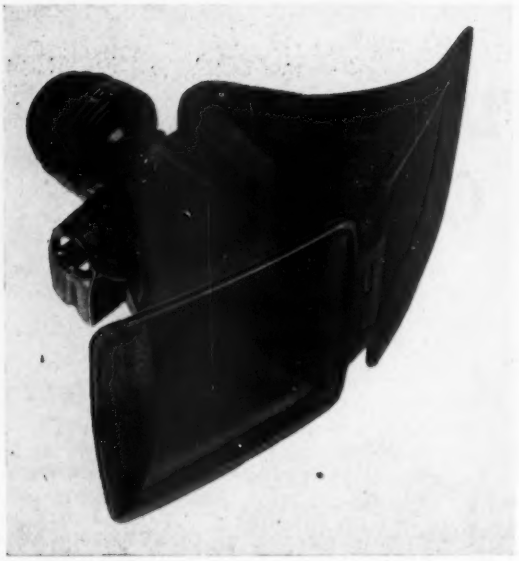
REDESIGN of a loudspeaker horn and it adaptation to die casting presents some interesting problems and equally interesting opportunities.

In order to make this perfectly clear some general idea of loudspeaker horns must first be outlined.

Horn loudspeakers are essentially trumpet-like structures having a cross sectional area which increase progressively from the throat or sound entrance to the front opening. The progressive increase in area is derived from an exponential formula.

To achieve the above general characteristic and to conserve space, the horn is usually made in three sections, plus the several purely mechanical parts which comprise the assembly. The three sections are the tone arm, the reflector and bell, each succeeding part being larger than the other, in the order named. They are arranged axially so that the smaller unit is

*Design Engineer, University Loudspeakers, Inc.



3. EXTERIOR SHAPE is derived solely from the required contours of the air or sound chamber. Size of this rectangular loudspeaker is 18½ inches across the face, with a mouth opening 9 inches high.

contained within the next larger unit. This arrangement forms a reflex chamber wherein the sound progresses through the tone arm, reverses direction in the reflector and continues in the initial direction, in the bell.

Figure 1 illustrates a conventional arrangement of this type of horn and shows the path of the sound wave.

It is apparent that a number of parts are required for assembly and they must all be assembled concentrically and their linear spacing accurately maintained. Moreover they must be securely fastened to prevent spurious vibrations which would directly impair the reproductive quality of the speaker. All of these conditions materially increase the cost of assembly. The driver unit is also shown in Figure 1 and, it too, is die cast but since it is a separate device its construction will not be considered at this time.

It may be assumed that the best approach to the redesign of a loudspeaker horn would be an attempt to eliminate or combine some of the many parts to reduce the possibility of vibration and also the cost of parts and assembly. It will be shown that die casting offered a ready answer to these problems.

Disposing the air column into two symmetrical halves as shown in Figure 2 reduced the entire structure into two basic parts which would require only one die. The air column was converted into rectangular cross-sectional shapes, which lent itself readily to economical die construction.

Advantages of using rectangular chamber

At the points where the sound wave changes direction in the sound chamber a differential occurs due to the difference in the radii of the inner and outer walls of the bend. This detrimental effect was greatly overcome by increasing the height of the area of the bend and consequently reducing the width. In this way the inner and outer radii were brought together as closely as possible.

The characteristic rectangular pattern of the sound chamber was continued to the outward extremity of the horn opening, in a divided pattern resulting in a dual exponential flare, or twin horn. This construction allows the sound wave to form a single frontal arc, resulting in a smooth sound radiation pattern, free of sound energy cancellation.

The continuous nature of the sound chamber and the smooth surface of its walls are added advantages of the use of die castings.

There is no waste of metal in the design of this speaker, as its exterior shape derives solely from the required contours of the air or sound chamber.

Decoration or surface treatment for eye appeal are unnecessary since this product is aimed at a technical market, wherein the product is judged on a basis of performance and durability of construction. Of course the general appearance has been translated into smooth efficiency in terms of acoustical equipment.

A loudspeaker horn which has a rectangular shaped mouth is commonly known as a Cobra and in certain uses is generally conceded to be better than a round horn. Most areas where speakers are used are rectangular in shape and a sound wave generated in a rectangular pattern tends to continue in this shape. The same effect is noted on round horns, the sound wave in this case being round, and therefore does not fill and penetrate the corner of the room.

A die casting offered the easiest solution to the rectangular pattern of design. In addition, the deliberate coincidence of the shape of the sound chamber and the structural shape, made possible an extremely rugged construction which promises lasting durability in this product.

Additional dividends were derived from the die casting techniques by providing two recesses for ½-13 square head bolts which are necessary to the attachment of the "U" bracket used to support the completed speaker.

At the front of the horn a half hole is cored in each cast-

continued on page 36

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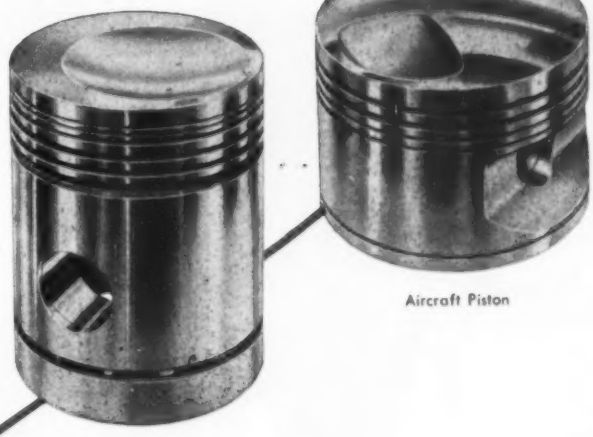

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ing. When two castings are assembled a complete hole is formed for a No. 6 self tapping screw. The screw is used to attach the name plate in a recess in the casting.

Other components of assembly are a die cast threaded collar having two keyways which mate with keys at the throat end of the horn. The driver unit is screwed into this sliding collar making secure contact with the casting. Eight rivets are used to assemble the horn. A gasket is also used between the tone arm and reflector to prevent the escape of sound energy at the critical points.

The amount of processing necessary to the assembly of this product has been reduced to a minimum. When the castings are received they are cleaned, anodized and painted with a baked enamel finish. No machining or other processing is required. The assembly also requires a minimum of labor and expense.

The engineers and technicians of Mt. Vernon Die Casting Company produce all of the die castings. Close cooperation between the designer and the die caster is evident.

Made in No. 85 aluminum in a die weighing over 2,000 pounds, the casting strikes a new note in the construction of loudspeakers.

The market has been presented with a modern product, designed and built to last and to carry consistently in reproductive quality. There is no question of variation in the product since every manufactured part is identical. The labor saved in inspection and assembly alone more than compensates for the tool expenditure. The consistent quality, durability and efficiency of the product, supplies the dealer with a worthy product and without service problems.

In these days of high cost of labor and expensive materials, die casting leads the way in economy without impairment of quality, opening up new horizons in construction and design in the manufacture of acoustic reproducers.

IRON SINTERING saves 45% over machined ratchet

GENERALLY speaking the more expensive machining operations are those performed on a milling machine. When, as is the case in the rachet illustrated, it is required to cut a difficult tooth contour and at the same time preserve a square shoulder between the toothed portion and the circular portion the cost of milling becomes excessive.

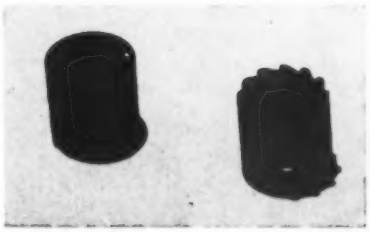
Because of the high machining costs, the Elliott Addressing Machine Co. of Cambridge, Mass, undertook a re-evaluation of possible methods of manufacture and selected powder metallurgy as the most economical one to give a part with the desired properties.

Functionally, this rachet rotates the felt inking roll on the hand operated Addresserette made by Elliott. Positive engagement with a pawl and good wear resistance are the prime requisites. Stresses on the part are light and did not have to be considered.

As presently being made the ratchet is an iron sintering made by the Merriman Bros. Co. of Boston, Mass.

Except for the set screw hole, the part is pressed and sintered to size and shape with no secondary machining operations required. After sintering the set screw hole is drilled and tapped. The ratchet is case hardened to give the wearing qualities required and then treated by the Dulite blackening process to give an oxidation and corrosion resistant finish.

As a final step the somewhat porous sintering is impregnated with oil so that it will be self lubricating for the life of the addressing machine.



The result of the change from a fully machined part to an iron sintering has been a reduction of 45 percent in the cost when the rachet is ready to be installed in the addressing machine. The self lubricating features have materially increased the life of the part and by having the piece made by an outside vendor machine tools (screw machines, drill presses and milling machines) have been released for other work thus lightening the shop load.

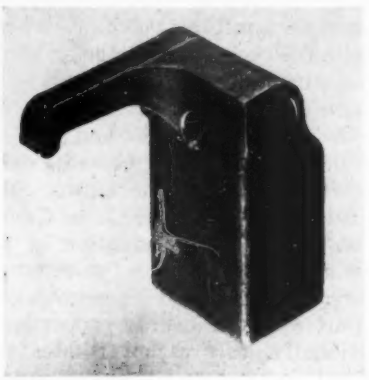
The highly successful application of a sintering in this one case has led the Elliott Addressing Machine Co. to re-examine many other small parts that are now being made by other processes to determine whether or not powder metallurgy can be more widely applied. Currently, several other parts are under consideration and many more will probably convert to sinterings in the future.

Coming in 1953 – These outstanding POWDER METALLURGY Features

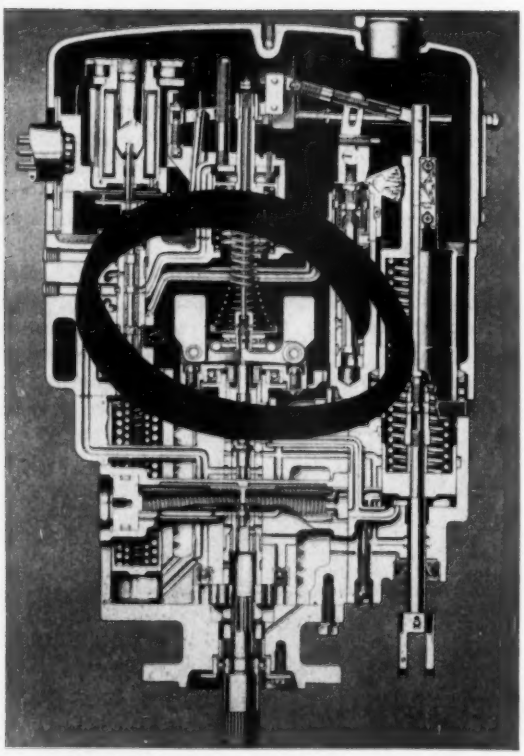
DURING 1953 PRECISION METAL MOLDING magazine will bring, in addition to "case history" type of articles, a group of papers being prepared by recognized leaders in the powder metallurgy field. Among these special articles will be:

Design & redesign for powder metallurgy; Dimensioning & tolerances for sinterings; Large sinterings; Inspection and testing of sinterings; Sealing & plating of sinterings; Presses for powder metallurgy; Electronic cores & core materials; The use of metal hydrides in powder metallurgy; Sintering furnaces; Statistical quality control.

MACHINED? BRAZED? FORGED? or INVESTMENT CAST?



1. SIMPLE SECONDARY operations are all that are required by this investment cast flyball.



2. FUNCTION OF FLYBALLS is critical in this locomotive governor, shown above in section.

HOW to produce the irregular-shaped flyball shown in Figure 1 was a difficult problem several years ago at the Woodward Governor Company, Rockford, Ill. A pair of these flyballs has a critical function in the performance of the company's PG locomotive governors.

This device is an electro-hydraulic and pneumatic hydraulic control with self-contained oil supply, oil pump and accumulators for storing pressure oil. Normal purpose of the PG governor is to maintain a constant engine speed regardless of load, although it may be supplied with speed drop characteristics if this feature is desired.

In its complex function of compensating for speed and load changes, the governor employs the pair of flyballs as indicated in the section view, Figure 2.

The flyball was at first machined from solid stock, but was found to be too slow and expensive. The large amount of metal which would have to be removed can readily be visualized.

The next technique attempted was a copper brazed assembly of two pieces. Again, costs were out of line and attention was given to forging as a possible method. The amount of trimming and extra machining cancelled out the lower first cost of the forging.

continued next page

Too costly to Machine?

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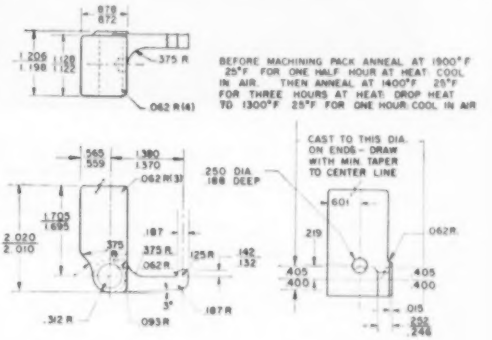
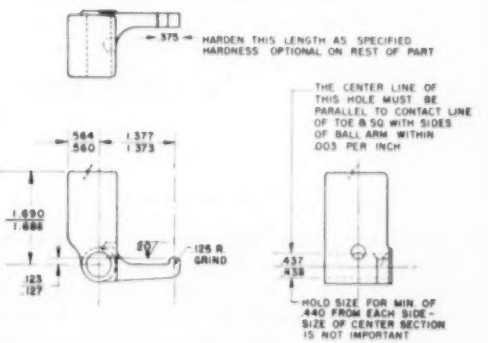
The solution of this problem has been investment casting in AISI E52100. As in so many instances where a part cannot otherwise be produced economically, the only secondary operations needed by the investment cast flyball consist of a milling and boring operation, plus a simple grinding operation.

Comparison of the casting and machining drawings for this part, Figures 3a and 3b, will make clear the few machining operations required.

Note that despite the accuracy of investment casting, little attempt has been made to attain dimensions which are excessively


BEFORE MACHINING PACK ANNEAL AT 1900°F 25°F FOR ONE HALF HOUR AT HEAT COOL IN AIR. THEN ANNEAL AT 1400°F 25°F FOR THREE HOURS AT HEAT DROP HEAT TO 1300°F 25°F FOR ONE HOUR COOL IN AIR
CAST TO THIS DIA. ON ENDS - DRAW WITH MIN. TAPER TO CENTER LINE
.375 R
.062 R(4)
.250 DIA .188 DEEP
.062 R(3)
.375 R
.062 R
.125 R
.062R.
.312 R
.093R
.187R
3°

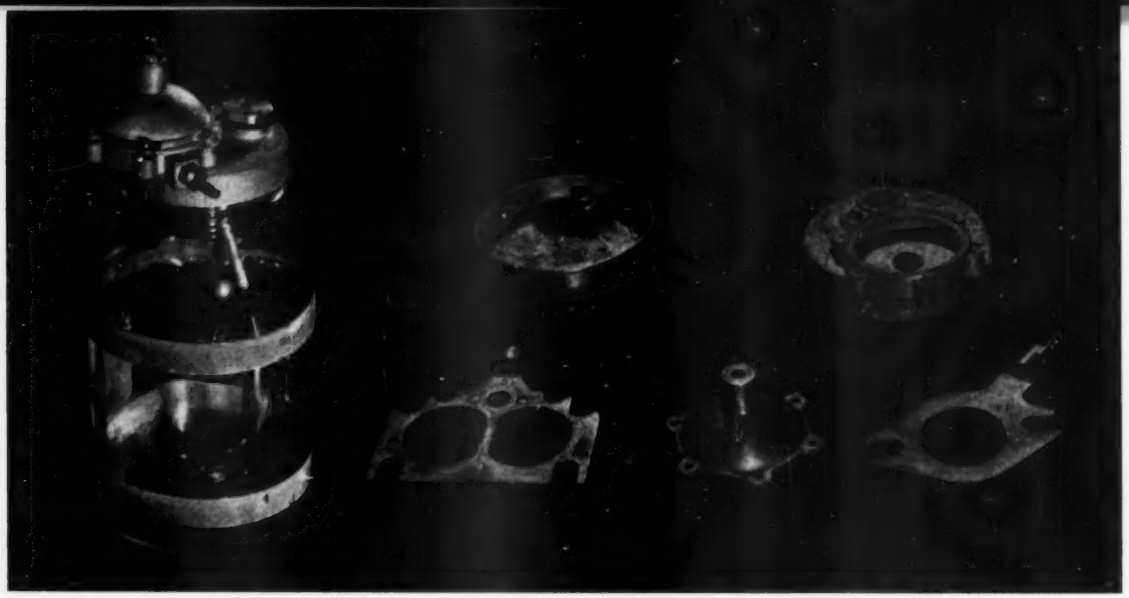
3a. **CASTING DETAIL drawing above shows finish stock allowed. Before machining, the casting is pack annealed at 1900F ± 25 for half hour at heat and then cooled in air. It is then annealed at 1400F ± 25 for three hours at heat. The heat is then dropped to 1300F for another hour and then cooled in air.**


.375
HARDEN THIS LENGTH AS SPECIFIED HARDNESS OPTIONAL ON REST OF PART
THE CENTER LINE OF THIS HOLE MUST BE PARALLEL TO CONTACT LINE OF TOE & SQ WITH SIDES OF BALL ARM WITHIN .003 PER INCH
80°
.125 R GRIND
HOLD SIZE FOR MIN. OF .440 FROM EACH SIDE - SIZE OF CENTER SECTION IS NOT IMPORTANT

3b. **MACHINING DRAWING reveals that all excessively close dimensions are finished, although only simple milling, boring and grinding operations are required.**

close for normal commercial investment casting tolerances. Thus, a dimension of 1.705-1.695 as cast is subsequently finished to 1.690-1.686, which is more economical than would be possible if the finish dimension were to be achieved directly by casting.

The casting is pack annealed before machining. Then, after machining, the extended portion is heat treated to 60-35 Rockwell "C" for a length of .375.



PRESSURE TIGHT DIE CASTINGS are basic requirements for the Hydro-Power Injector. When installed on a car, the unit, left, adds moisture to the intake air, increasing the power and smoothness of operation of the engine. Reverse and obverse views of head casting are shown above right; valve cover, center foreground; two carburetor plates, right and left foreground.

Pressure-tight DIE CASTINGS used in moisture injector

By LAVERN BERG*

IT HAS long been known that an internal combustion engine using gasoline as a fuel will operate most efficiently when the air mixed with the gasoline vapor has a high relative humidity. The smoother operation of an automobile engine after dusk is a phenomenon familiar to most motorists; less well-known, however, is the reason-increased moisture content of the air. If, therefore, the proper amount of moisture could be added to the intake air at all times, the smoother, more efficient night operation could be secured all of the time. The amount of moisture to be added varies considerably under different climatological conditions, but for average driving, almost anywhere in continental United States at least, about 15 percent of the intake should be saturated with water vapor to give the best operation. One of the devices which will accomplish this end is the Hydro-Power injector manufactured by the Hydro-Power Mfg. Co. of Denver, Colorado.

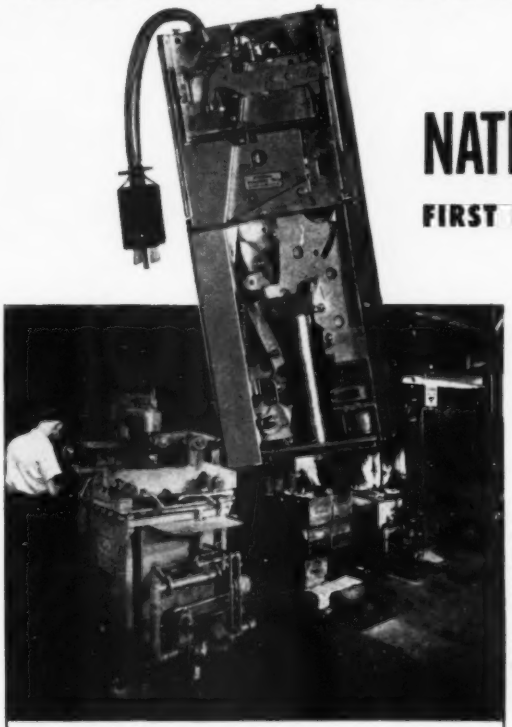
A complete injector, except for the carburetor plate and rubber hose, is illustrated above. The device is connected to the intake of the engine and hence, the head member, which fastens to the glass jar, must operate under reduced pressure. Since this head member carries a filler plug, air intake, and a flow regulating valve, it is rather complicated. Possible manufacturing methods include machining from wrought stock, machining a rough sand casting or die casting. Of these, die casting is by far the most economical and with properly made parts, a vacuum tight part is assured.

continued on page 62

*Secretary-Treasurer Hydro-Power Injector Co., Denver, Colorado.

KUX

FIRST NAME IN DIE CASTING MACHINES



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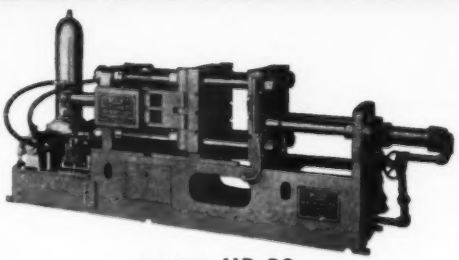

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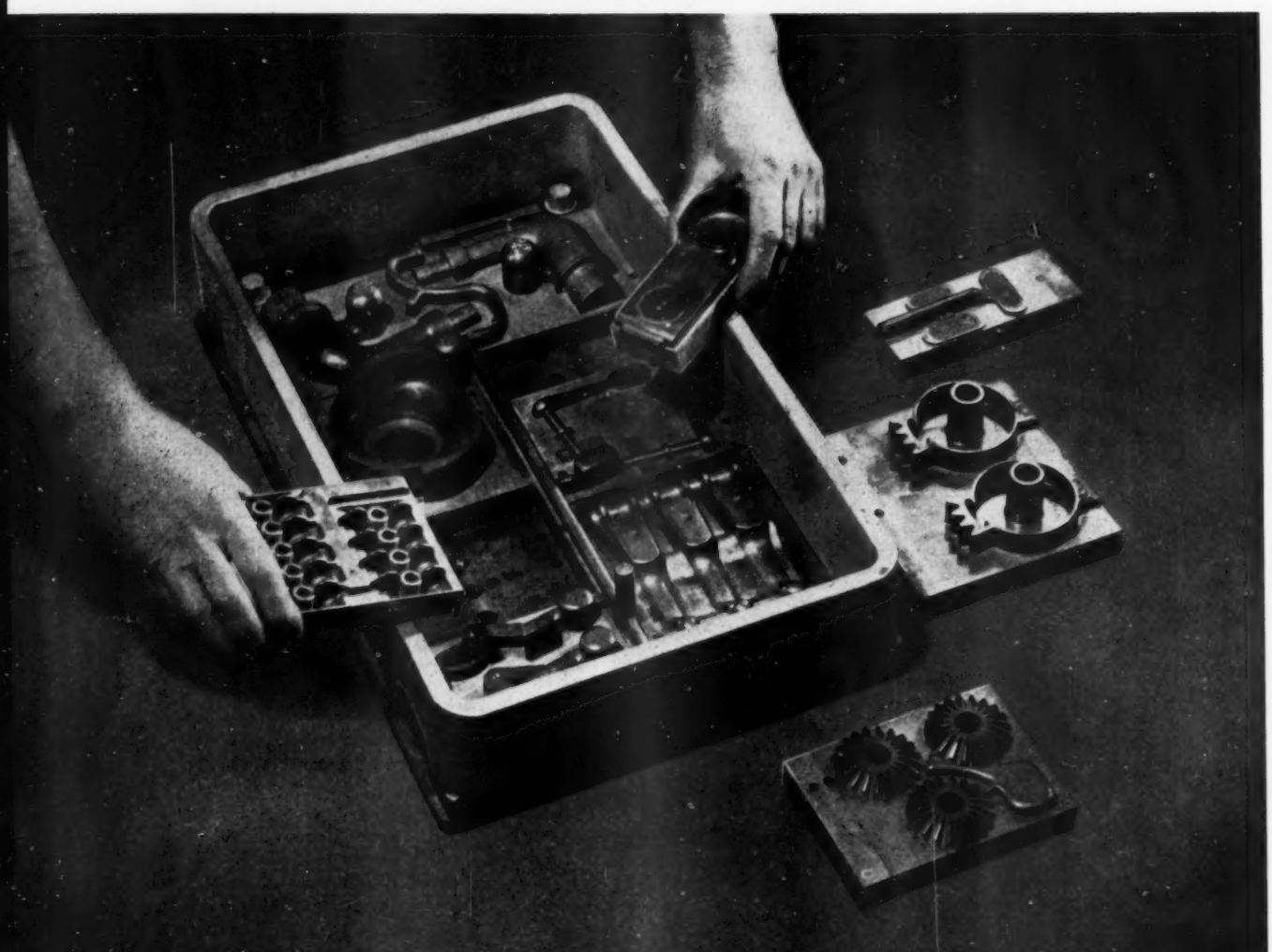


Photo courtesy Universal Castings Corp.

Here's how The "Unit Strip" System Aids the designer and buyer of PLASTER MOLD CASTINGS

THE unit strip system of flask loading has given to the plaster mold casting industry a flexibility that is unique in a mass production industry. This flexibility has been accomplished by utilizing the unit strip system of flask loading. By simply removing two or more machine screws, the pattern for any one part can be removed from a flask and another pattern substituted for it. Replacement of the pattern section and tightening of the screws readies the flask for continued pouring of the plaster.

In this manner, it is possible to make one, one hundred or several thousand parts from a single pattern at only a slight difference in unit cost. Pattern costs are, of course, not considered since they will be fixed regardless of the number of castings made.

Just what is this unit strip system, why is it possible to make a few or a larger number of castings for about the same price, and what advantages does it offer the designer and purchasing agent?

As is well known, there is a similarity between sand casting and plaster mold casting in that both processes use a pattern mounted on a plate (a metal match plate in the case of sand casting) and the mold material is placed around the pattern enclosed in a so-called flask. Here the similarity ends.

> The metal match plate for sand casting is a single fixed unit and any changes of it require a major operation on the part of highly skilled mechanics. With the unit strip system, anyone who can use a screw driver can make the necessary changes to remove one pattern and substitute another in a matter of two or three minutes.

Visualize, please, a standard flask approximately 10 x 18 x 2½ inches deep. These dimensions vary slightly among foundries. Through the center of the flask, running the length of the 18 inches, is a permanently attached metal runner pattern, ⅜ inches wide which divides the flask into two sections.

Each section is then subdivided to form in the flask 16 to 20 equi-sized portions called unit strips, on which the brass pattern or patterns can be mounted. Thus, the individual patterns can be mounted on a single portion or over several.

A runner connects each pattern with the master runner in the center of the flask.

Obviously, now, if 10 castings are to be made from a single pattern, the flask makes 10 full circuits on the plaster mold pouring machine and can then be removed. The unit strips are quickly removed and other substituted with a different pattern mounted on them and the flask put back into the mold pouring circuit.

This system, a basic feature of the Capaco* process requires only that castings in the same alloy to be poured at the same temperature be scheduled for a single flask. There are no limitations as to the number of identical pieces that can be made from a single pattern.

From the brief description given above, the advantages offered the design engineer and purchasing agent are at once obvious. Since pattern costs are quite low, generally not over $200 per pattern except for very complex castings, the process can also be used where only a very few parts are needed or for experimental assemblies before a design is finalized.

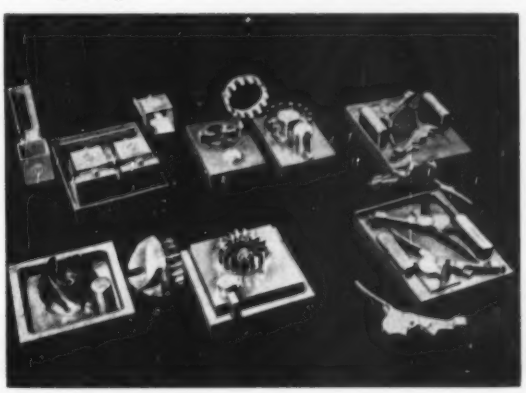
Parts that are to be die cast in production can be made experimentally by plaster mold casting without the high die charges and all necessary changes made before investing in expensive dies.

There are several techniques for producing non-ferrous castings from gypsum plaster molds. Future articles in PMM will discuss features of these processes.

Where there may be some question as to strength, wear resistance, etc., a plaster mold casting may often be the least expensive method of securing a small number of parts for testing.

Alloy types, as long as they are non-ferrous, can also be determined through the use of castings made by this process.

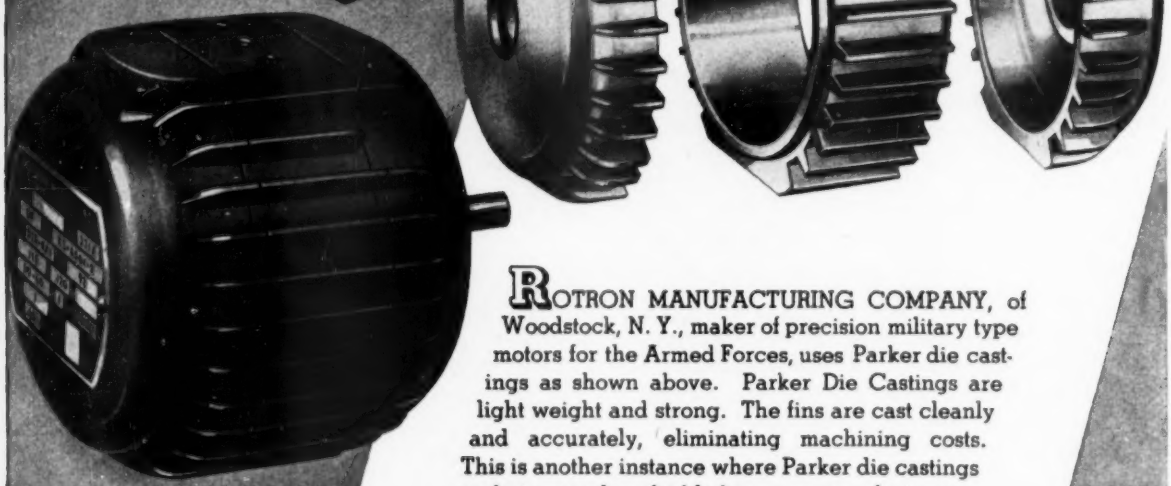
A GROUP OF PATTERNS is shown, together with the castings which have been produced from them. Photo courtesy Atlantic Casting & Engineering Corp.



*A patented process owned by Castings Patent Co.

PARKER DIE CAST FINS

save machining cost for **ROTRON!**



ROTRON MANUFACTURING COMPANY, of Woodstock, N. Y., maker of precision military type motors for the Armed Forces, uses Parker die castings as shown above. Parker Die Castings are light weight and strong. The fins are cast cleanly and accurately, eliminating machining costs. This is another instance where Parker die castings are being used profitably by many manufacturers. They know that die castings are economical. Parker die castings are in use in many industrial products where minimum weight, exceptional strength and lowest costs are important factors. Consult with Parker on your next die casting requirements. Our engineers will work with you to our mutual benefit.

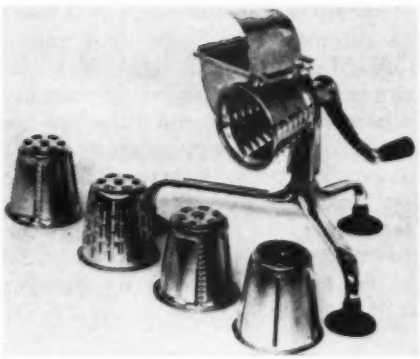
and when you think of Die Castings **THINK OF**

Parker White-Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER ALUMINUM *and* ZINC *Die Castings*

Chromium plating over die cast aluminum suggests many new applications for this type of casting.

What future for plated aluminum DIE CASTINGS?



"For general kitchen ware, die cast aluminum has long been popular. The added attraction of chromium plate will be welcome . . . "

ONE direction in which die cast applications are likely to increase in the next few years is in the use of aluminum die castings with chromium plated surfaces.

While aluminum does have the inherent quality of providing a useful and attractive surface with only a mechanical treatment such as polishing, tumbling or blasting, there are a number of applications where consumer preference or service conditions demand the harder, more brilliant chromium plated surface.

Problems relating to the application of a satisfactory chromium plate over aluminum have been studied extensively and systems for achieving it have been worked out.

In the early days of the die casting industry, it was felt that acceptable chromium plate over zinc die castings would never be accomplished, but the technical and production problems have received the attention of both die casting and plating specialists, with the result that millions of zinc die castings are being successfully plated for automotive and other consumer products each year.

Evidence has been forthcoming that aluminum die castings are likewise reaching the point where they can be chromium plated on a production basis. Some products with chromium plated aluminum die castings are now on the market.

One of these is the Saladmaster illustrated above. This kitchen appliance is built principally of five aluminum die castings produced by Litemetal Dicast, Inc. of Jackson, Mich., and chromium plated by Imperial Plating and Metal Finishers, Inc., of Waterloo, Ind.

The individual die castings which go into this unit are likewise illustrated here, showing quite clearly that neither size nor com-

continued next page

plexity of shape is necessarily a barrier to the accomplishment of plating quality die castings in aluminum alloy.

It is known also that at least two major producers of photographic equipment have been using chromium plated aluminum die castings with notable success.

The main problem insofar as the die caster is concerned, appears to be the production of aluminum die castings with "hardware finish".

One of the first considerations, of course, is the selection of the correct aluminum alloy for plateability. It must be an alloy with moderately wide freezing range in order to side-

"The main problem is the production of aluminum die castings with 'hardware finish' . . . "

step flow marks, cold shuts and other surface defects which prevent sound plating. The alloy used for the Saladmaster die castings, for example, is No. 380.

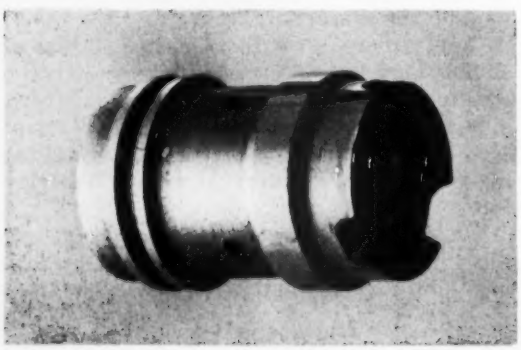
The die casting process itself must also be very closely controlled where plating quality die castings are to be produced in aluminum. Especially close attention is given to die temperatures, casting conditions and the several variables such as metal temperature, injection pressure, die lubrication, etc. Skill in die design, flexibility in die casting equipment, and increased operator skill are all a part of the picture in producing aluminum die castings that can be plated.

Once a casting has been produced with plating quality surface, there appears to be little difference in polishing, buffing, cleaning or plating operations, whether the alloy is zinc or aluminum base.

Two examples cited above, the Saladmaster food cutter and the photographic products, indicate two of the principal industries which will make increased use of plated aluminum die castings. For general kitchen ware, utensils, appliances and hardware, aluminum has long been popular. It has received public acceptance for equipment to be used with food. Here, the added attraction of chromium plate will be welcome.

For photographic equipment, weight reduction is a basic consideration, with durability and sales appearance not far behind in design significance. For cameras, projectors, tripods, flash attachments and other accesories, these parts may find increased use.

The automotive, portable tool and household electrical appliance fields may also find chromium plated aluminum die castings useful where they are competitive in finished price. These large volume users of die castings are among the bell-weathers of American industry, insofar as acceptance of new materials and techniques are concerned. Their reception of chromium plated aluminum die castings would be closely watched by many other fields of manufacturing.



HOW WOULD YOU MAKE THIS?

This part is a steel piston used in the valving system for hydraulic brakes. This is the prototype of many small machine parts now in production. It requires moderate physicals somewhat lower than average carbon steel, and is not subject to much wear. Tolerances range from ± .003 to ± .005 on most dimensions. How would you produce it? To find out how it is actually being formed, please turn to page 78.

PMM

Finishing Section

SURFACE FINISHING

Most precision metal molded parts receive some type of surface finish such as plating, organic coating, anodic coating or chemical coating. This section includes information on the methods, processes and equipment used in these surface treatments.

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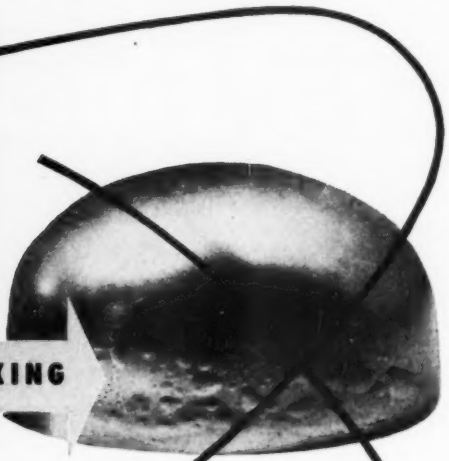

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Porosity is an inherent quality of sinterings. This permits impregnation with oil for self lubrication, but when sinterings are to be plated, this porosity is a handicap. A metallurgist here suggests a method for overcoming the porosity of sinterings so that they can be satisfactorily plated.

Impregnation as a method of preparing SINTERINGS for plating

By WILSON N. PRATT*

POROSITY in powdered metal parts has been a serious detriment for two types of applications:

1. Unimpregnated sinterings could not be plated satisfactorily.

2. Unimpregnated sinterings could not be used where pressure tightness was required.

Relative to plating of powdered metal parts, some techniques have been employed with some success to eliminate porosity in the past. These methods have proven either too costly or too complicated to warrant their use economically. For instance, infiltration with lower melting point alloys has been used but it requires difficult metallurgical controls involving mutual solubilities, controlled atmospheres, etc.

Silicone treatments will work on certain types of metal powder parts which may be plated without immersion in hot platers' cleaning solutions. The principle in this process is to make each pore water repellant. Again, exacting controls are required; this fact plus limitations of the process and the fact that porosity is not eliminated have prevented any general use of the silicones for plating.

Ball peening has been tried to close the voids on the surface in order to electroplate. Changes in tolerance, changes in surface metallurgical properties, control difficulties and unsatisfactory results have limited the use of ball peening.

The basic problem in plating sinterings is that the platers' cleaning solutions containing caustic and the plating solutions (either acid or basic - cyanide solutions) penetrate the metal pores. These chemicals react with the metal or pick up water vapor and carbon dioxide from the air, causing corrosion and the formation of salts which soon occupy more volume than the pore. The excess material, either a corrosion product or a carbonate or both, escapes from the pore at the surface of the part thru the void in the plating. The exudation results in unsightly appearance and cannot be permanently washed off because the corrosive action continues.

In addition to plating problems, porosity has prevented the general use of powdered metallurgy where the parts must be pressure tight.

After two years of development, American Metaseal Corp. has developed a method of impregnating sinterings which accomplishes three objectives:

1. Fills the voids permanently and invisibly so that parts can be successfully plated with no subsequent spotting out, freckling, blistering or other corrosive reaction.

2. Makes parts pressure tight so that they will hold pressures of over 5000 psi.

3. Prevents internal corrosion under any conditions.

While castings have been successfully impregnated for many years, the inherent porosity of sinterings has made impregnation not only very difficult but

continued next page

*Director of Development, American Metaseal Corp.

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In sanding beveled edges of a steel guide for vending machines, a prominent company* decided to use backstand belts instead of set-up wheels. The switch *increased production from ten to thirty guides per hour!* Here is more proof that Armour backstand belts are more efficient, more economical than set-up wheels.

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also expensive. The reason for this is two-fold:

1. After filling the pores in the part it was necessary to wash the impregnant from all surface areas; the excessive porosity resulted in the washing of the impregnant from not only surface areas but also from the pores themselves.

2. Much of the impregnant remaining in the pores after washing exuded or "bled" out of the pores during the curing cycle.

Because of these two conditions it has been necessary to give sinterings repeated "shots" in order to attain reasonable pore filling. The cost of repeated treatments has generally been too high to warrant the process.

With the new process for impregnating sinterings to eliminate porosity the above difficulties have been overcome.

The material used to fill the pores is a thermo-setting polyester-styrene copolymer (Metaseal 19V5). This plastic is inert, non-corrosive and resistant to acids, alkalis, salt water, alcohols, glycols, gases and all solvents. It has no effect on, nor is it affected by any metal alloy. It withstands temperatures of from —75 F to 400 F.

The following are steps in impregnation of sinterings by Metasealing.

1. Parts are degreased, if necessary, and pre-baked at 250 F to 300 F to remove all moisture from the pores.

2. Parts are impregnated with 19V5 in pressure vessels under vacuum and pressure so that complete pore penetration is attained.

3. Impregnant is removed from all interior and exterior surface areas as well as from blind taps, threads, channels, etc., in a special

emulsifying cleaning bath which does not remove the impregnant from the pores.

4. Parts are cured at 250F to 300F to polymerize the impregnant in the voids. In this curing process, developed especially for sinterings there is no loss of the impregnant due to exudation or "bleeding".

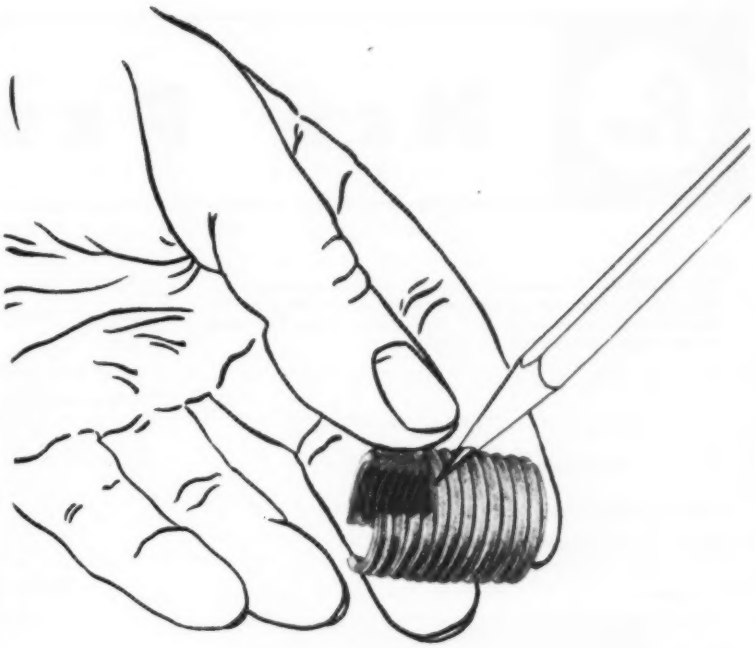
The process is economical because the material cost is very low and because one treatment is all that is generally required. Size, design or complexity of the metal parts has no appreciable effect on the process or cost.

The process is identical and equally satisfactory for all ferrous and non-ferrous metals. Because Metaseal 19V5 is copper stabilized, a unique characteristic for thermosetting polyester-styrene plastics, it offers a new field to bronze powder metallurgy in making valve, pump, and other pressure components.

ASTM STANDARDS ON PAINT, VARNISH, LACQUER

The eighth edition (September 1952) of the compilation of ASTM Standards on Paint, Varnish, Lacquer and Related Products provides in convenient and up to date form each of the more than 200 specifications, tests, and definitions issued by the American Society for Testing Materials through the work of its Committee D-1. Also included are related standards from other committees. Committee D-1 comprising prominent authorities representing consumers, producers, and general interests, has sponsored seven previous editions of this volume, the last being in 1949.

Copies of this 800-page book can be obtained from Headquarters of the American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa., at $5.75 each, in heavy paper cover.

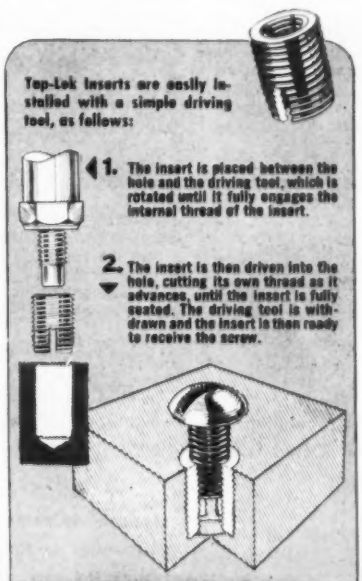


Tap and insert in one operation—

—with TAP-LOK INSERTS*

The Tap-Lok Insert offers an effective, low-cost method of preventing stripping of tapped threads in softer-than-steel materials. It is a steel or brass bushing threaded internally and externally, and provides a hard, long-wearing thread surface.

Slotted segments at one end of the insert enable it to tap its own thread as it is turned into a cored or drilled hole equal in size to a tap drill hole for its external thread. This self-tapping feature eliminates the separate tapping operation required by other types of bushings. The saving in time and labor makes it the most practical and economical method of tapped thread protection that has ever been devised.


Tap-Lok Inserts are easily installed with a simple driving tool, as follows:
1. The insert is placed between the hole and the driving tool, which is rotated until it fully engages the internal thread of the insert.
2. The insert is then driven into the hole, cutting its own thread as it advances, until the insert is fully seated. The driving tool is withdrawn and the insert is then ready to receive the screw.

The insert retains its seat firmly against vibration. It affords maximum torque-and-pull resistance and is not subject to the time-consuming failures of molded-in and cast-in inserts. Widely used as original equipment, the Tap-Lok Insert is ideal also for salvage and repair of stripped threads.

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NEW PRODUCTS

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

EFFICIENT MELTING FURNACE FOR INVESTMENT CASTING

Detroit Electric Furnace Div.
Kuhlman Electric Co.

SPECIAL FEATURES: Melting furnaces developed for production of investment castings, especially in the jet aircraft field. Furnace consists of melting chamber and transformer combined into a single unit. Can be used to cast stainless, chrome-nickel heat resisting steels, and super alloys.

SPECIFICATIONS: Melting chamber has a 2-piece refractory seated in granular insulation and provided with tubular entrances for electrodes and for pouring. The investment mold clamps onto the shell face by means of compressed air.

The transformer is a 17 KVA adjustable reactance, Class B, dry type, available for either 220 or 440 volts, 60 or 50 cycles, single phase supply.

The operator pours the heat by inverting the furnace and allowing the molten metal to run into the clamped-on mold. As soon as the casting has solidified, the operator releases the air pressure and removes the mold before returning the furnace to melting position. An integrating kilowatt hour meter tells the operator approximately the progress of his heat, an indicating watt meter tells him rate of energy input.

Average melt time is 6 lbs. in 9 minutes when casting Stellite type alloys. Average elapsed time per heat is 12 minutes.

For additional information Circle No. 196 on Reader Service Card

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BONDING RUBBER TO METAL

Advance Rubber Co., Inc.

SPECIAL FEATURES: Process bonds natural, synthetic or silicone rubber to metal. New method allows metal cores to be ground to tolerances of ± .002. Nuts and bushings of rubber can be tightened without breaking. Metal can be used in many places to give rigidity to rubber. Reduction in inventories and speedup of assembly are also reported to be advantages.

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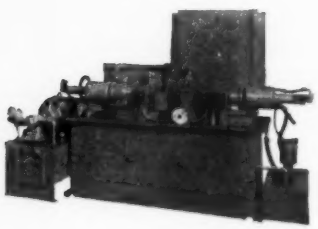
DRILLING & DEBURRING UNIT

Govro-Nelson Co.



SPECIAL FEATURES: New electrically interlocked machine drills and deburrs 6 holes in a steel disc at a rate of about 260 pieces per hour.

SPECIFICATIONS: Machine incorporates 2 Govro-Nelson automatic drilling units, each equipped with 6-spindle multiple head. In operation, the operator loads the part on a locator & presses a start-switch which causes the part to be automatically clamped. One unit then feeds in automatically to drill six

continued next page

3/32" diam. holes, whereupon the second unit feeds automatically from the opposite side to deburr the holes. Part is automatically unclamped at completion of the operation. Machine can be adapted to other drilling and deburring operation.

For additional information Circle No. 198 on Reader Service Card

TWIN-BARREL FINISHING BARREL IN STANDARD SIZE

Rampe Mfg. Co.

SPECIAL FEATURES: Sturdily built machine will handle steel burnishing balls in both barrels. Low cost is a special feature.

SPECIFICATIONS: Powered by ¾ hy 220 V 3-phase motor; ball bearing variable speed drive; completely waterproof starting button. Standard barrels as furnished are 10¾" x 17", and larger barrels can be supplied. Barrels are attached by four bolts each and are furnished plain or vinyl plastic lined with safety type cover which prevents pressure from building up in the barrels.

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MULTI-PURPOSE LITHIUM GREASE

Alvania Grease
Shell Oil Co.

SPECIAL FEATURES: Exceptionally high resistance to breakdown is characteristic of lithium-base grease. Also featured are high water tolerance, broad temperature range, high pumpability, and movement at low temperatures, low rate of oxidation and long induction period. Reported to replace as many as 20 different types of grease. Stays in bearings longer, extending period between relubrications.

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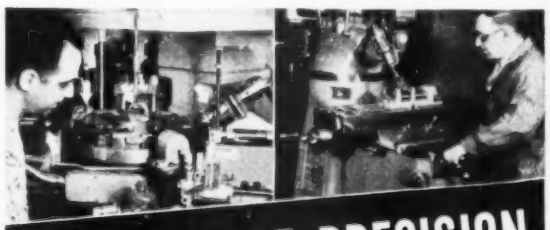
continued on page 52



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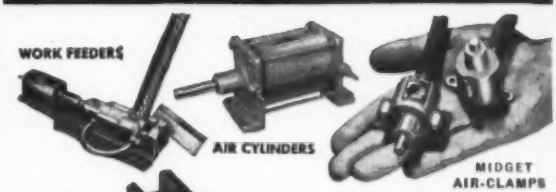

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CERAMIC TUMBLING MEDIA FOR DEBURRING

Crown Pebs

Crown Rheostat & Supply Co.

SPECIAL FEATURES: Extra long service life is reported for the newly developed tumbling media for barrel deburring and finishing. Selection of proper size eliminates "lodgement" hazard said to be due to random sizes of chips.

SPECIFICATIONS: Available in variety of sizes; manufactured from tough, white ceramic material. Uniform size, shape and density give uniform processing results.

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COMPACT BENCH MILL

Rotex Punch Co.

SPECIAL FEATURES: Compact bench mill of sturdy design. Special construction provides great rigidity.

SPECIFICATIONS: Table surface 5" x 20"; large diameter spindle supplied with No. 10 B & S or No. 4 Morse taper operates at 15 different forward or backward speeds; all ways are dovetail type and are hand scraped.

Work is power fed at .003, .006 or .012 per spindle revolution. ½ hp motor recommended, available with or without motor, vertical head, stand, arbors or other accessories.

For additional information Circle No. 202 on Reader Service Card

GATE CUT-OFF MACHINE

Acme Saw & Manufacturing Co.

SPECIAL FEATURES: Radial gate & riser cut-off for non-ferrous castings is said to make such a clean cut off that chipping, bandsawing & other hand operations are eliminated. Cuts to max. 55" radius.

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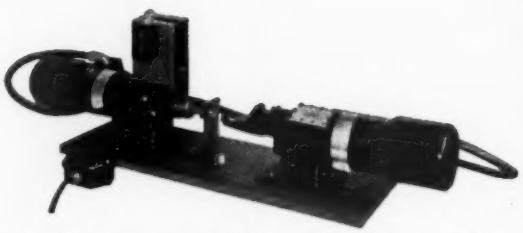
continued on page 54

STANDARD OPPOSED DRILLING MACHINE



This Standard Govro-Nelson Drilling Machine is supplied completely wired so that the two Automatic Drilling Units work simultaneously from a momentary contact palm or foot switch with a dowel hole for fixture location. (Fixture not included.)

With the Units adjustable endwise up to 18" between chucks, it can be used as a centering machine. By mounting a simple hand-index fixture, it can be used for drilling wire holes in cap screws. Two opposed holes can be drilled at once. A riser plate permits the drilling of offset holes.

Reduce Production Costs!

Why not drill two holes at the cost of one with this standard, versatile machine? Write for literature, sending samples and part prints.

Automatic **DRILLING UNIT**

WRITE FOR *Literature*

GOVRO-NELSON CO.

Machinists of Precision Parts for 28 Years

1933 Antoinette

Detroit 8, Mich.

For additional information Circle No. 54 on the Reader Service Card

DIVISION OF **ALMCO** QUEEN STOVE WORKS, INC.

Supersheen
SPEED FINISHING

ALBERT LEA, MINN.

The Greatest Finishing Story Ever Told!

NAME★ Leading Automobile Mfgr.

DATE	MODEL NO.	SERIAL
6/18/48	DB-2	1234

Initial Order 1 Unit—Re-ordered 27 units since original purchase

NAME★ Large Gear & Ball Bearing Mfgr.

DATE	MODEL NO.	SERIAL
10/1/46	DB-2	1040

Initial Order 1 Unit—Re-ordered 25 units since original purchase

NAME★ Leading Business Machine Mfgr.

SHIPMENTS

DATE	MODEL NO.	SERIAL
6/30/52	DB-200	445

Initial Order 1 Unit—Re-ordered 32 units since original purchase

NAME★ Leading Appliance, Radio & T. V. Mfgr.

DATE	MODEL NO.	SERIAL
12/4/46	DB-8	1096

Initial Order 1 Unit—Re-ordered 36 units since original purchase

NAME★ Large Chain & Sprocket Mfgr.

SHIPMENTS

DATE	MODEL NO.	SERIAL NO.
7/28/51	DB-400	259
7/28/51	DB-400	260

Initial Order 2 Units—Re-ordered 24 units since original purchase

NAME★ Leading Appliance & Electrical Equip. Mfgr.

DATE	MODEL NO.	SERIAL
1/5/48	DB-2	1172
1/5/48	DB-2	1173
1/5/48	DB-2	1174
1/5/48	DB-2	1175

Initial Order 4 Units—Re-ordered 74 units since original purchase

THESE CARDS FROM OUR FILES TELL THE STORY! Six years ago Almco Supersheen was a new name in the barrel finishing industry. Today it's the world's most complete and *largest selling* line of barrel finishing equipment and materials. Re-orders from large and small manufacturers have made this remarkable growth possible.

Almost all types of metal parts are now being deburred and finished at sensational cost savings with Supersheen Advanced Speed Finishing.

IN A REVIEW OF 10 TYPICAL ALMCO SUPERSHEEN INSTALLATIONS, finishing costs averaged 80.1% less than former methods—from 48% on a threaded cast iron pipe "T"—to a 95% savings on a steel trigger with intricate configurations.

The coupon below will bring you full information about equipment prices, processes and free services.

★ NAME ON REQUEST

FREE 22 PAGE BOOKLET
NEW REVISED EDITION

This 22-page booklet is guaranteed to open your eyes! The inside story of Advanced Barrel Finishing as never told before! Shows why Almco SUPERSHEEN Equipment pays for itself in as little as two months! A single-unit replaces from 2 to 12 men. Savings up to 95% on almost ALL types of parts with absolute uniformity, fewer rejects, finer finishes!

Send coupon today for your *FREE* copy.

ALMCO SUPERSHEEN
Dep't D-1 Albert Lea, Minn.

Please send Free Booklet "Advanced Barrel Finishing" equipment catalog, and details about your Free Sample Processing and Free Engineering Service.

Name _____ Title _____

Address _____

City _____ State _____

ALMCO Supersheen SPEED FINISHING

WORLD'S LARGEST SELLING LINE OF BARREL FINISHING EQUIPMENT—MATERIALS AND COMPOUNDS, FREE SAMPLE PROCESSING, FREE ENGINEERING SERVICE

STUDY THE FACTS!

ZINC with Luster-on® IS SUPERIOR TO CADMIUM for most industrial applications

Preconceived notions that cadmium plating just naturally offers better protection than zinc are contrary to the true facts. Simply because cadmium is freer again is no reason for re-converting to it. Cadmium is still and always will be far more costly than zinc. When the zinc is passivated in Luster-on conversion treatment it is far superior to cadmium for all but extremely specific applications. These are basically (1) a marine atmosphere and (2) a bearing surface.

FACT NO. 1

ZINC plus LUSTER-ON is DEFINITELY SUPERIOR TO CADMIUM IN AN INDUSTRIAL ATMOSPHERE.

FACT NO. 2

ZINC plus LUSTER-ON is DEFINITELY MORE ECONOMICAL THAN CADMIUM.

BUT IF YOU MUST USE CADMIUM to meet specifications, the new LUSTER-ON Cd, specially developed to use on Cadmium plate, will give you a BETTER, BRIGHTER CADMIUM.

Write for free data sheets on Luster-on Treatments

THE Chemical CORPORATION
66 Waltham Ave., Springfield 9, Mass.

Circle No. 67 on the Reader Service Card

continued from page 52

TESTS METALS FOR RESISTANCE TO HEAT CHECK

Thermo-Test
Henry G. Keshian

SPECIAL FEATURES: In recent years many notable advances have been made in the art of permanent mold and die casting, drop forging, hot piercing, extrusion, etc.; but the well-known die failure due to high temperature fatigue, also known as heat checking, still remains as a serious problem.

Similarly, many parts used at high temperatures, such as the parts of automotive and aircraft engines and other internal combustion engines, turbine blades, etc., fail under thermal stresses or heat shocks.

SPECIFICATIONS: Thermo-Test is said to determine the relative resistance of different materials to heat checking. Test pieces are successively heated, stressed, and cooled This cycle of heating, stressing and cooling is repeated until the specimen develops visible cracks or heat checks.

The number of cycles required to produce heat checks are indicated on a counter attached to the machine. As many as eighteen test pieces can be tested at one time. The effects of various heat treatments, the range of heating and cooling, amount of pressure applied to the specimen and the effects of various alloying elements on the resistance of steel to heat checking can be studied. Various materials used for molds, permanent molds, die casting dies, glass molding dies, drop forging dies, hot piercing mandrels, extrusion dies, hot rolls, etc., can be tested. This patented mechanism measures approximately 24" wide, 36" long and 18" high.

Circle No. 214 on Reader Service Card

COMPOSITION FOR DIE CASTING COLOR FINISHING

Aluminum Oxide Compositions
Hanson-Van Winkle-Munning

SPECIAL FEATURES: Series of aluminum oxide compositions is said to be especially suited for coloring operation in the finishing of zinc and aluminum base alloys.

Ordinarily used for steel and stainless steel finishing, the results for coloring die cast alloys are reported to be exceptional. There are five compositions.

Circle No. 215 on Reader Service Card

Here's why Pangborn HYDRO-FINISH prolongs the life of your dies!

BECAUSE Hydro-Finish employs fine mesh abrasives suspended in water, it does a precision cleaning job without danger of excessive metal removal. Tolerances are held to .0001"! Result: more years of service from your dies!

What's more, Hydro-Finish saves you time and labor. Operated by one man, it removes scale and discoloration in *minutes* instead of hours! Cleaned surfaces are virtually free of directional grinding lines, eliminating or reducing further finishing operations.

Get the facts on how Hydro-Finish can save you money! Write today for Bulletin 1400A. Address: PANGBORN CORPORATION, 3500 Pangborn Blvd., Hagerstown, Md.

Get **PANGBORNITE.** Best abrasive for all liquid blasting needs. Available in many mesh sizes.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control equipment.

Pangborn

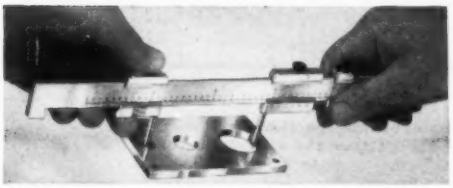
BLAST CLEANS CHEAPER
with the right equipment for every job

Circle No. 68 on the Reader Service Card

CENTER DISTANCE GAGE

Center-Mike

Sorensen Center-Mikes, Inc.



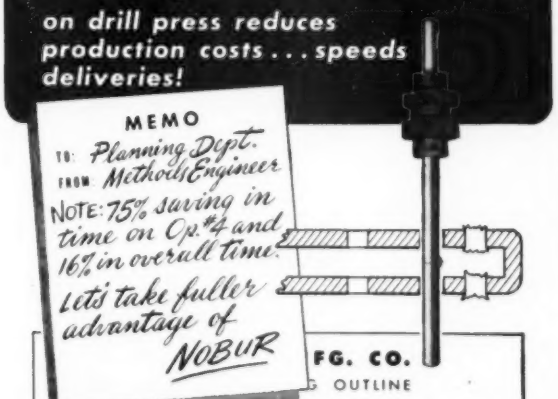
SPECIAL FEATURES: Measures distance between hole centers quickly without knowledge of diameters or mental calculation. Unit is a direct-reading vernier gage combined with slide rule. Also used for measuring distance from hole center to a parallel surface.

SPECIFICATIONS: In operation, the Center-Mike is first set to the closest points on the two holes and then reset to the farthest points on the same holes. While the operator makes these two settings, the two lengths automatically are registered and their average value computed by the Center-Mike. This value, equalling center-distance, appears on double-size vernier scale. Supplied in 3 sizes for max. distances of 4.400", 7.4000", and 12.400" respectively. All sizes are useable for any combination of holes where both are larger than .002 inch. Optional equipment extends range downward to .061 diam. Work contacts are tungsten carbide and scales are machine graduated.

For additional information Circle No. 203 on Reader Service Card

Deburring with NOBUR tool

on drill press reduces production costs . . . speeds deliveries!

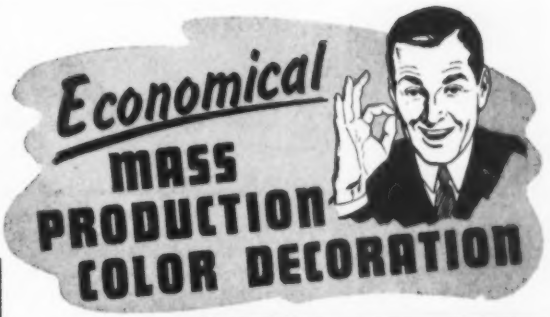

MEMO
TO: Planning Dept.
FROM Methods Engineer
NOTE: 75% saving in time on Op. #4 and 16% in overall time!
Let's take fuller advantage of NOBUR
FG. CO.
OUTLINE
OPER NO | MACHINE | DESCRIPTION | TIME
1 | TURRET | BORE & FACE PER PRINT | 5 MIN
2 | MILL | STRADDLE MILL PER PRINT | 3
3 | DRILL | 10 HOLES LINE DRILL | 6
4 | BENCH | DE-BURR HOLES | 4
4(REV.) | NOBUR TOOL IN DRILL PRESS | NOBUR HOLES | 1
TOTAL 18 15

For further information, write or wire today

NOBUR MANUFACTURING COMPANY

719 NORTH VICTORY BLVD. • BURBANK, CALIFORNIA

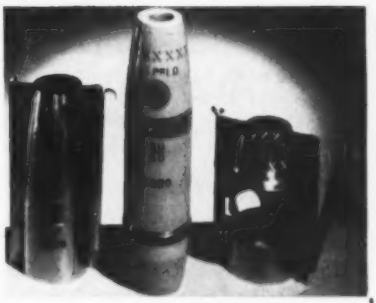
For additional information Circle No. 73 on the Reader Service Card



Cut spray decorating costs by rapidly wet painting three-dimensional parts, one color after another through the use of

ELECTRO-FORMED METAL SPRAY PAINTING MASKS

(Made by Patented Process)



and foot treadle air - operated clamps, fixtures and tools which position and hold the piece snugly in the mask; and permit the operator to use both hands. Plug-type masks for keeping depressed areas clear, while spraying background; lip-type masks for protecting the background while painting depressed areas; and block cutout plane surface type masks.

Clean, sharply defined letters and decorative effects are obtained on intricate die castings, stampings and plastic forms by accurate control of painted areas with no fogged edges. After-wiping or buffing off of overspray is unnecessary. The "loose" inside of letters and numerals, such as "O" and "6", is held in position by arched bridging to eliminate objectionable "ties."

We design, engineer and build automatic, entirely air-operated machines for spray decorating a variety of small parts at speeds of up to 3600 per hour. Eliminate the

hazards of electric motors, mercury or solenoid switches and the cost of explosion-proof electrical equipment.

Masks are inserted so as to be flush with top of the working table. Spraying is from below. Frequency of mask cleaning greatly reduced. Dial regulates the cycling speed. Using a conveyor belt, operator can use both hands to load. Another dial regulates the amount of paint sprayed. At any given setting, the same amount of paint is sprayed on every part, regardless of the speed of the loading cycle. Effects paint savings of up to 50 percent over hand spraying.

Employs 8 latest automatic guns and two 2-gallon air-agitated paint pressure tanks with four insert containers. We also build mask washing equipment.

SEND COUPON NOW!

CONFORMING MATRIX CORPORATION

346 Toledo Factories Bldg. Toledo 2, Ohio

Please send without obligation, details on ( ) Hand masks; ( ) Mechanical masking fixtures; ( ) Air operated masking fixtures; ( ) Stationary automatic spray painting masking machines; ( ) ( ) Mask washing equipment; ( ) Quotation on masks for parts (or prints) which I am forwarding.

NAME .....

FIRM .....

STREET .....

CITY ..... STATE .....

For additional information Circle No. 52 on the Reader Service Card

PMM USEFUL LITERATURE

For additional information on the products appearing on this and the following pages, mark the key number of the item on the card bound into this issue. Drop the card in the mail—no postage is required.

PROCESSES

Die Casting Facilities: **No. 144**
Facilities of Rupert Diecasting Co. in Kansas City and Chicago are illustrated in a folder from the company.

Magnesium & Aluminum Permanent Mold: **No. 145**
The use of the light metals for many types of products based on permanent mold and sand casting methods, is the subject of a new brochure, "New Horizons for Product Improvement with Magnesium and Aluminum Castings," from Rolle Manufacturing Co., Inc.

Design of Investment Castings: **No. 146**
Reprints of an article "Design of Precision Cast Parts" including design rules for reducing die cost and casting difficulties, are available from Howard Foundry Co., Investment Casting Div.

Heavy Metal by Powder Metallurgy: **No. 147**
An 8-pg technical information bulletin from P. R. Mallory & Co., Inc., is devoted to the company's 1000 Metal, a heavy machinable metal of high density produced by powder metallurgy. It is an homogeneous alloy of tungsten, nickel and copper which permits strategic placement of a large mass in a small or confined area.

"Movie" of Investment Casting in Leaflet: **No. 148**
Feature of a new leaflet issued by National Precision Casting Corp. is a "minute movie" of the investment casting process. Also included are many sample castings and some background information on the process.

Chrome Carbides to Resist Corrosion: **No. 149**
Technical Bulletin WR-104 from Carboloy Dept. of General Electric Co. gives full information on properties on their new chrome carbide material produced by powder metallurgy. The Series 600 cemented chrome carbides are reported to be resistant to corrosion, abrasion and erosion.

Sealing Porosity in Rejected Castings: **No. 150**
In 23 pages of questions and answers, plus a general introduction, Tincher Products Company offers full technical and process information on its method of impregnation to seal porosity in rejected castings.

Catalog of Carbides: **No. 151**
A catalog of carbide alloys issued by Carmet Division of Allegheny Ludlum Steel Corp. contains recent information on production techniques and new applications for sintered carbides.

Design Ideas for Zinc Die Castings: **No. 152**
In No. 3, Vol. 20 of The Alloy Pot published regularly by the New Jersey Zinc Co. are contained several case histories of zinc die castings which suggest ideas for designers working with metal componenets. Also included is data on the use of beryllium copper for die casting die cavities supplementing information originally introduced by PMM.

Curing Shell Molds with Electric Heat: **No. 153**
Contained in issue No. 48 of Chromalox News is an illustrated report on the use of electric heat used to cure shell molds used in the new shell molding process. Photograph of the operation and drawings showing the sequence of operations are included.

MATERIALS & EQUIPMENT

Air Power Catalog: **No. 160**
Just off the presss is Mead Specialties Company 1953 catalog of air power devices, including single and double-acting air cylinders, air operated presses, vises, chucks, valves, hammers and work feeders. Catalog has 56 pages.

Direct-Reading Analysis of High Alloy Steels: **No. 161**
Vol V, No. 3 of the Spectrographer's News Letters published by Applied Research Labs, gives information about obtaining true direct-reading analysis of high alloy steels.

Metal Melting Furnaces & Accessories: **No. 162**
In a new 20-page catalog, Stroman Furnace & Engineering Co. introduces its complete line of metal melting furnaces and furnace room accessories. Furnaces designed specifically for use in die casting aluminum are featured, along with furnaces for many other non-ferrous melting operations.

Retaining Ring Catalog: **No. 163**
In a new 52-page catalog, Waldes Kohinoor, Inc., offers engineering specs, data and other information covering 17 different types of Waldes Truarc retaining rings and more than 600 sizes.

Small Die Casting Machines: **No. 164**
In a new leaflet from A. B. C. Die Casting Machine Co., a small size zinc die casting machine is introduced. Automatic timing, low die costs, high speed cycling are special features.

Preventing Thread Stripping in Light Metals: **No. 165**
The engineering of screw threads to prevent stripping is the subject of a well presented booklet from Heli-Coil Corp. By means of helical wire inserts inserted into tapped holes in any metal (but especially die cast and other light metals), stripping is prevented.

Hydraulic Cylinder Bulletin: **No. 166**
A new 28-page bulletin from Lindberg Engineering Co. describes and illustrates a complete line of hydraulic cylinders. Diagrams, photos & charts explain different mounting types and capacities up to 1500 psi and 3000 psi working pressure.

How Grinding Wheels Work: **No. 167**
Using a photo-magazine technique to present its story, Cincinnati Milling Machine Company introduces its new line of grinding wheels. Photos, including 1800X enlargement of the action of a grinding grit, show how grinding is accomplished, how grinding wheels are made and inspected.

FINISHING

Comprehensive Tumbling Barrel Catalog: **No. 172**
Newly published Catalog B-8 shows a full line of tilting and horizontal type tumbling barrels from Globe Stamping Div. of Hupp Corp. Two pages of detailed specifications are included.

Self-Sticking Spray Masks: **No. 173**
In a file-folder type of catalog separated into individual categories, W. H. Brady Company introduces its full line of self-sticking industrial products including spray masks & stencils, wire & pipe markers, safety signs and roll tapes.

Tin-Nickel Plating Process: **No. 174**
Commercial development of a new plating process is announced in a laboratory bulletin from Metal & Thermit Corp., Chemical Div. The new development is a tin-nickel alloy (65-35) reported to be bright, corrosion resistant and free of stresses, even in thick deposits.

Scientific Metal Cleaning: **No. 175**
A folder entitled Scientific Cleaning for Modern Metal Finishing has been received from Kelite Products, Inc., listing and describing briefly the company's many products for all types of metal cleaning operations.

continued next page

Ionic High Potential Paint Spraying: No. 176

Introduction of the Ionic Gun for ionic high potential paint spraying, reported to have 8 specific advantages, is the subject of a folder from Scientific Electric.

Alkaline Derusting with PR: No. 177

New application for Enthone's alkaline derusting compound No. 134 is announced in a bulletin showing how periodic reverse current makes this compound useful for scale removal.

Self-Priming, Corrosion-Resistant Paint No. 178

U. S. Stoneware Company has released a 16-page bulletin on Tygon paint, giving full information in this self-priming.

Corrosion-Resistant Paints & Primers: No. 178

U. S. Stoneware Company has released a 16-page bulletin on its Tygon paints and vinyl primers in the field of corrosion-resistant coatings. Bulletin tells where, how and how not to use Tygon paints and primers.

Brush-On Protective Coating for Aluminum: No. 180

A folder from American Chemical Paint Co. is devoted to Brush Alodine, a brush-on or sprayed coating to protect painted or unpainted aluminum.

NEW PRODUCT BRIEFS

204. FINE BURRING, GRINDING & POLISHING operations on metal, plastics, rubber & similar materials performed with new Bench-master belt sander. Large, 4" diam. belt wheels, heavy-duty ball bearings, unique trackage adjustment, are features.

205. LIQUID RESIN FOR SAND CORES offered by Durez Plastics & Chemicals, Inc. Advantages claimed for new phenolic type binder include: longer storage life, lower cost, excellent bond strength, low volatility.

206. INSPECTION OF CASTINGS with black light for fluorescent penetrant is facilitated with new Burton Magnifier black light which meets Air Force Specs. Twin-tubes generate prolific but harmless 3660A ultra violet energy. Flaws are viewed through triple-power glass.

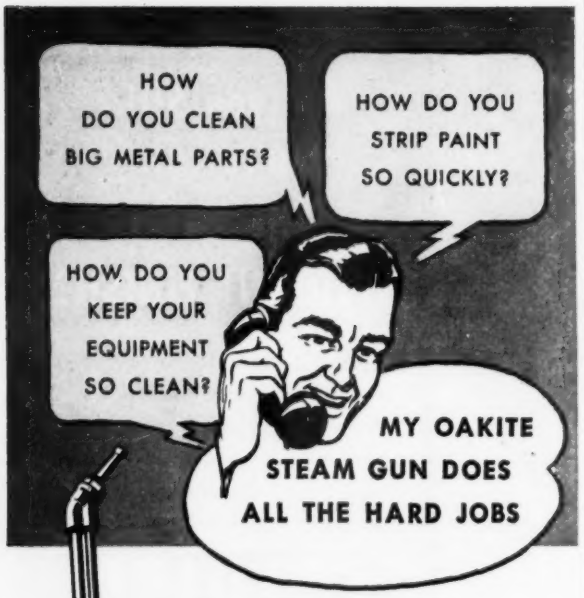
207. STREAMLINED AIR CYLINDER design is announced by Tomkins-Johnson Co. which eliminates rods and reduces head size to result in saving of up to 40% of mounting space.

208. FLAME-RESISTANT CURTAIN protects workers against chips, spatterring metal, welding, etc. Produced by Eastern Equipment Co., it consists of either curtains or blankets of flame-resistant canvas in sizes to 100 sq. ft.

continued next page

Are you SURE you're using THE MOST EFFICIENT FINISH?
If your production involves finishing zinc, cadmium, aluminum or cuprous metals, you owe it to yourself... and your customers... to investigate
IRIDITE
for on any of these metals Iridite gives you a high performance finish at a low cost from a simple chemical dip.
IF YOU WANT HIGH CORROSION RESISTANCE, you'll find an Iridite that will meet any military or civilian specifications for chromate finishing.
IF PAINT ADHERENCE IS IMPORTANT, you'll find Iridite prevents underfilm corrosion and soap formation.
OR, FOR BRIGHT, DECORATIVE FINISHES–
investigate zinc plate and Iridite (Bright) for a chrome-like decorative finish with more corrosion protection than conventional chrome plating . . . or Iridite (Metcote) as a treatment for copper that eliminates the need for buffing in the copper-chrome system; produces a sparkling bright finish!
Write for literature and send us samples for test processing. See "Plating Supplies" in your classified telephone directory or write direct.
Iridite is approved under government specifications.
ALLIED RESEARCH PRODUCTS
INCORPORATED
4004-06 E. MONUMENT STREET • BALTIMORE 5, MD
Manufacturers of Iridite Finishes for Corrosion Protection and Paint Systems on Non-Ferrous Metals; ARP Plating Brightener.
West Coast Licensee: L. H. BUTCHER COMPANY

For additional information Circle No. 35 on the Reader Service Card


HOW DO YOU CLEAN BIG METAL PARTS?
HOW DO YOU STRIP PAINT SO QUICKLY?
HOW DO YOU KEEP YOUR EQUIPMENT SO CLEAN?
MY OAKITE STEAM GUN DOES ALL THE HARD JOBS

Yes, his Oakite Steam Gun does practically every cleaning job that's too big or too difficult for ordinary methods.

It cleans metal parts that are too large for tanks or washing machines . . . It strips paint from large surfaces . . . It cleans large equipment such as:

die casting machines
wire drawing machines
blooming mill rollers
brass reduction machines
millers and grinders
drill presses
stamping machines

FREE For your copy of "*Time saved with Oakite steam-detergent cleaning*" write to Oakite Products, Inc., 34G Rector St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE
Technical Service Representatives in Principal Cities of U. S. & Canada

For additional information Circle No. 55 on the Reader Service Card

NEW PRODUCT BRIEFS — Cont.

209. HALF-PRICE VAPOR DEGREASER that is portable, electrically-operated on 110 or 220 v, and having 2½ gal. solvent capacity, has been introduced by J. D. Wallace & Co. Plug-in element provides heat-up time of less than 20 minutes.

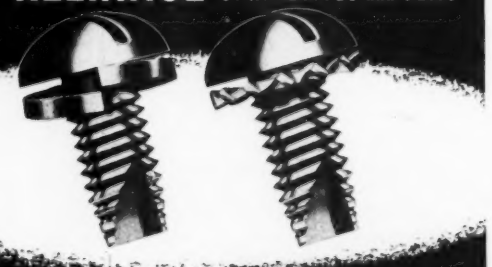
210. FLOW CONTROL VALVE for air or hydraulic use introduced by Pneu-Trol Devices, Inc., provides full flow in one direction and a wide range of adjustments in the opposite — or controlled — direction.

211. NEW TYPE OF SET SCREW introduced by Set Screw & Mfg. Co. has a cup point so designed that it provides greatly increased holding power with the same amount of setting torque.

212. LOAD-BEARING dry lubricant finishes may be applied to any machine or instrument surface by brushing or spraying. New type "Liqui-Moly" molybdenum base lubricating enamel offered on an experimental basis by The Lockrey Company has lustrous, hard, greasy-feeling but clean coating.

213. COLD CLEANERS used for industrial metal cleaning at room temperatures has been streamlined into an efficient process by E. F. Houghton & Co. New Houghto-Clean 439 and 440 combination used in power washers removes such soil as heavy drawing compounds, sulphurized cutting oils, rust preventives, etc.

• ELIMINATE TAPPING COSTS
• REDUCE ASSEMBLY TIME
• BALANCE INVENTORIES
WITH **RELIANCE** "THREAD CUTTING" SPRINGTITES and SEMS



Pre-assembled Springtites and Sems Especially Designed For Use with Die-Castings

Available with or without washers

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EATON MANUFACTURING COMPANY
OFFICES AND PLANTS • MASSILLON, OHIO
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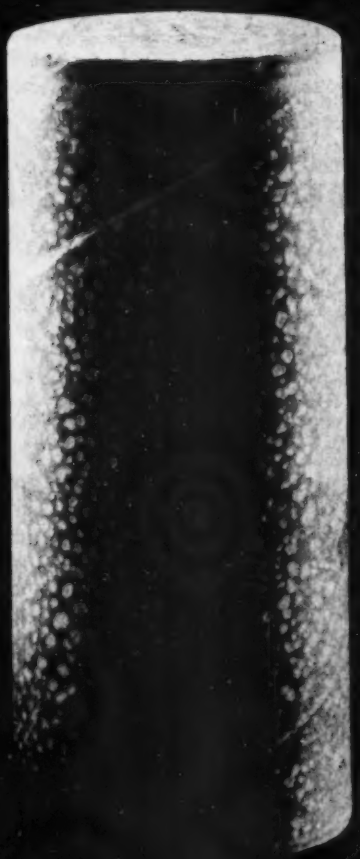
EATON

For additional information Circle No. 75 on the Reader Service Card

STANDS ALONE



Roberts

DIE CASTING
BRICKETTE
for final finishing

Send For FREE Samples

You will be agreeably surprised at the results.

13¢ per lb. F.O.B. STRATFORD or order from your jobber.

ROBERTS
DISTINCTIVE FINISHING COMPOUNDS

Since 1881

THE ROBERTS ROUGE CO. STRATFORD, CONNECTICUT

REFERENCE MATERIAL, catalogs and data offered free in this month's ads (circle numbers on reader service card.)

1. AUTOMATIC POURING of aluminum for cold chamber die casting is introduced by Ajax Engineering with literature about new melting-pouring equipment.

4. HOW TO BE SURE of buying "on-grade" zinc alloy die castings is the subject of a detailed brochure from the American Die Casting Institute.

5. DIE CASTING MACHINE catalog from Cast Master presents full line of zinc & aluminum machines.

7. SMALL DIE CASTINGS produced by a specialized department of Dollin Corp. are subject of a booklet. Sample castings included.

8. DIE CASTINGS is the title of booklet offered by Hoover Co. describing its facilities.

9. INVESTMENT CASTING questions & answers, plus many examples of investment castings, are in a brochure from Howard Foundry's investment casting division.

12. DIE CASTING MACHINES produced by Kux are covered in a complete catalog.

13. LATEST NEWS on die casting machines & plastic presses is contained in publication by Lester-Phoenix.

15. HOW TO CUT finishing costs by use of Velvaglaze aluminum castings is subject of brochure from Monarch Aluminum.

21. MANY FURNACES for melting aluminum, brass and other metals are presented, along with specs, in catalog from Stroman Furnace.

22. STEEL-BELTED PISTONS for all types of engines are subject of a data book from Thompson Products Light Metals Div.

25. REVISED EDITION of a 22-pg booklet on barrel finishing methods is available from Almco Supersheen.

26. TWO METAL CLEANERS, an electrocleaner & a heavy duty soak tank cleaner, are covered in a pair of bulletins from Diversey Corp.

29. ALUMINUM CASTING facilities of Acme Aluminum are presented in an illustrated brochure.

30. PLASTER MOLD CASTINGS produced to close tolerances reported in data book from Atlantic Cast- & Engrg.

32. DIMENSIONING DIE CASTINGS is subject of a guide book from Newton-New Haven Co.

35. IRIDITE FOR PROTECTING metal surfaces is described in literature from Allied Research.

36. BACKSTAND BELT POLISHING is subject of informative booklet from Armour & Co.

37. SCREWTHREAD INSERTS for use in die cast metals are subject of a data sheet from Groov-Pin.

39. ZINC & ALUMINUM die castings produced by Advance Tool & Die Casting Co. are introduced in a newly published booklet.

42. CENTRIFUGAL INVESTMENT castings produced by Electronicast are the subject of a folder telling about the process & its applications.

43. SMALL DIE CASTINGS — review of size, alloy & design limits in folder from Gries Reproducer.

44. ZINC ALLOY SUPPLIERS, Henning Bros. & Smith, offer a monthly house organ called The Henning Messenger.

45. HOW TO DESIGN aluminum & magnesium die castings is subject of a data book from Litemetal Dicast.

48. SMALL TOOLS FOR DIE work and a regrinding service for keeping them in good cutting condition, are presented in a catalog from Severance.

50. PLASTER MOLD CASTING — what it is & what it offers the designer — is covered in illustrated brochure from Universal Castings.

52. PAINT SPRAY MASKS of various types are offered in literature from Conforming Matrix Corp.

54. HOW TO DRILL two or more holes for the cost of one is subject of literature from Govro-Nelson.

55. TIME SAVED with Oakite steam-detergent cleaning is subject of booklet offered by Oakite.

56. MACHINES for producing small zinc die castings are presented in folder from A. B. C. Die Casting Machine Co.

58. ALLOYS FOR INVESTMENT casting are described in literature from Cannon-Muskegon.

62. DESIGNING FOR POWDER metallurgy is subject of handbook from International Powder Metallurgy.

67. CHROME-LIKE BRILLIANCE and methods for applying it to zinc surfaces are reported in literature from Chemical Corp. describing their Luster-On dip.

68. LONGER LIFE FOR DIES is reported in bulletin from Pangborn Corp. describing Hydro-Finish process for wet blasting die casting dies.

71. REFERENCE FOLDER on line of P-V investments for investment casting process is offered by Pre-Vest.

72. AIR POWER CATALOG from Mead Specialties includes air cylinders, valves, presses, vises, chucks and other types of equipment.

73. DEBURRING OF HOLES by means of new type tool is subject of folder from NoBur.

74. MULTIPURPOSE GRINDER & MILLER is described in illustrated literature from Precise Products.

75. THREAD CUTTING SCREWS with pre-assembled Springtites & Sems designed for use with die castings are covered in engineering bulletin from Reliance Div. of Eaton.

80. INVESTMENT CASTINGS are subject of booklet offered by Hitchiner.

81. DIE CASTING MACHINES produced by Lake Erie Engineering are covered in bulletin 23-1.

LINDBERG GOES WEST

Lindberg Engineering Co., 2450 W. Hubbard St., Chicago 12, Ill., manufactures of industrial heat treating furnaces and supplies, has purchased 4½ acres of land adjoining the Southern Pacific Railroad tracks in Los Angeles, Calif.

The Company plans the building of a plant and offices for the manufacture of all types of Lindberg heat treating and Lindberg-Fisher melting furnaces as soon as possible.

Complete manufacturing equipment will include a railroad siding and cranes for loading and unloading of heavy units.

ADVANCE works with REX-O-*graph* to make a *good product a BETTER PRODUCT*

REX-O-graph builds good office duplicating machines. These duplicators turn out 300 or more copies from one master with great speed and efficiency.

ADVANCE engineers applied die-cast "know-how" to make this good product a BETTER PRODUCT. Multiple assembly operations were eliminated by converting several components to ONE die casting — exceptional die design reduced machining in others — redesign built strength and sales appeal where these attributes were needed.

Chances are that one or more components in your product can be converted to zinc or aluminum die castings to the advantage of your production budget and product quality. Send us your drawings and quantity requirements for an ADVANCE engineering study and proposal.

ADVANCE operates under the CERTIFIED ZINC PLAN of the American Die Casting Institute.

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PRESSURE-TIGHT
continued from page 38

Included in Figure 1 are reverse and obverse views of the head casting made by the Gem Die Casting Co. of Denver, Colorado. Other than assurance of vacuum tightness, there are several features of the casting that are worthy of special note.

The jar used to contain the water has a threaded neck for closure. Because it is necessary from time to time to remove the head, the casting must contain matching threads. However, the position of installation on the engine fire wall and the rubber tubing which connects the injector unit to the manifold preclude the use of a full thread. Use is made, therefore, of a segmented core in the casting die. By this, it means it is possible to form thread segments so that less than a quarter turn is required to either loosen or tighten the head on the jar. While such a segmented core materially increases the initial die cost, the saving by not having to machine out a majority of the threads as a secondary operation more than compensates for increased die costs.

A second place where the use of die casting allows a material cost reduction is through the use of a cast-in brass insert which acts as a seat for the flow control valve. The primary requirement here is that the insert should not move under the load applied by the adjusting spring. By simply knurling the insert, sufficient anchorage is secured to give the desired immobility. Were this insert applied as a separate piece, a threaded part would be needed to secure the same result at a materially higher initial cost plus the cost of installation.

The seat for the diaphragm in the flow valve should not be smooth. If the rubber diaphragm is to be tight, a grooved seat is most desirable. This would require a separate machining operation were another method of manufacture used. By die casting, however, the desired degree and kind of surface roughness can be incorporated in the die so that the surface comes from the machine ready for use.

Other cored holes in the head are for the filler plug, the air inlet, and six hold-down holes for fastening the valve cover into the head. All of these holes are cored to size so that finishing consists of tapping only.

While this part was originally designed to be made as a die casting, it is quite easy to see that any other method of manufacture would be materially higher in cost.

The cover for the diaphragm valve and the carburetor plates are the other parts of the injector made by die casting. The valve cover (Figure 1) is cast ready for use except for tapping the center hole and drilling a

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Specifies **BADGER**
DIE CASTINGS . . .

Badger die castings are used by almost every phase of industry — large and small. Evidence of this preference is pointed up by the fact that the manufacturers of all sizes of gasoline engine — from the small utility models to the large industrial units have specified Badger die castings for over 33 years.

Consult Badger on all your die casting problems

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tiny breather hole. The casting is a nice example of housing casting and particularly emphasizes the ability of zinc to be die cast with quite thin walls.

The carburetor plates have several features worthy of special note. Obviously, flatness is essential so that a good gasket seat can be secured. In the plate for the dual-throat carburetor, the position of the ejector pins can be clearly seen. Provided that the flash is removed from around the pins, there is no need to surface grind since the position of the pins is such that the marks will not interfere with proper seating and sealing by the gasket. As cast, both types, single and dual throat, plates are sufficiently flat so that no surfacing or grinding needs to be done.

The moist air from the injector is introduced into the gasoline-air mixture through these carburetor plates. The connection for the hose running between the humidifying unit and the carburetor plate is shown in Figure 1. Passage of the air through the casting is provided in the dual plate by drilling two small holes in the casting. In the single throat plate, however, only one hole is needed and it is cored. This coring job is exceptional due to the small size of the core. As finished, the rectangular hole is about 7/32 × 3/64. Holding and pulling a core of this size is no mean trick.

FIRST MAGNESIUM EXPO TO BE HELD IN MARCH

The first International Magnesium Exposition ever to be held will take place March 31, Aprl 1 and 2, 1953 in the Washington National Guard Armory, Washington, D. C. The exposition will be sponsored by The Magnesium Association, according to A. W. Winston, president of the organization.

The exposition will be open to the public and will provide "the greatest concentration of magnesium know-how, demonstrations and exhibits ever housed in one location."

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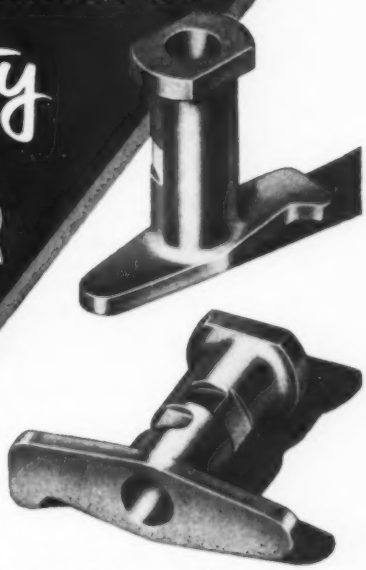

Torque Tube for Gyroscopic Application Investment Cast from S Monel ACTUAL SIZE

Mr. J. B. Lyons* tells us that in the pilot construction stages this torque tube was fabricated in two parts, the flange and the tube and then they were brazed together. Then Hitchiner Precision Investment Castings entered the picture. The resultant saving in turning, profiling, milling, drilling and boring and the elimination of the brazing meant a tremendous saving in cost . . . AND as Mr. Lyons says: "All this has been accomplished without sacrifice of quality."

*Mr. Lyons is Purchasing Agent of the Doelcam Corp., Newton, Mass.

This free folder tells you more about Hitchiner Precision Investment castings . . . send for it today

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PROMOTIONS and APPOINTMENTS

Six scientists added to the research staff of *Allis-Chalmers Mfg. Co.* include MATT BUSHNER, WALTER EDENS, W. B. HARRISON, DIMITRI KECECIOGLU, DONALD F. KUEMMEL and DR. ARTHUR B. MICHAEL.

New associate director of engineering for *P. R. Mallory & Co., Inc.*, Indianapolis, is VICTOR WELGE, formerly head of Electronics and Missile Section for Consolidated Vultee Aircraft.

At *SIPI Metals Corp.*, Chicago smelters, MAURY E. LIPPERT has been appointed general sales manager.

JOSEPH S. IMIRIE has been named to the newly created position of assistant to the president of *The Carborundum Co.*, Niagara Falls, N. Y.

Appointment of JOHN J. McDERMOTT as sales engineer for *Gries Reproducer Corp.* in the metropolitan New York and New Jersey area, has been announced by the company. Also, C. J. McAVOY CO. in Memphis, Tenn., has been selected to represent the company in Tenn., Miss. and Ala.

Election of two new directors and a new secretary for *Gerity-Michigan Corp.*, Adrian, Mich. has been announced. They are ROBERT T. DUNLAP and HAL A. KROEGER, directors, and J. Cary THOMPSON, JR., secretary.

ANDREW E. ST. JOHN has been elected president, and C. A. HECHT, vice president, of *Alloys & Products, Inc., N. Y.*

HENRY K. MOORE has been appointed field engineer in the Southern Philadelphia area for *The Bellows Co.*, Akron, Ohio.

FRED W. SCOTT, JR., has been appointed manager of the newly established *Merchandising Sales Div., The Carborundum Co.* of Niagara Falls, N. Y.

ERIC BRIERLY has been named sales engineer in the Cleveland branch office of *Reed-Prentice Corp.*

PMM INDUSTRY NEWS

MANAGES DIE CASTING MACHINERY DIV. AT HPM

Richard K. Schrecongost has been appointed manager of the die casting machinery division of The Hydraulic Press Manufacturing Co., Mt. Gilead, Ohio.

R. K. SCHRECONGOST

Prior to coming with H-P-M in September, Mr. Schrecongost was plant manager of Pressco Casting & Mfg. Co., and was also associated for a time with SUS Die Casting Company as sales manager and assistant to the president. A good portion of his 15 years experience in the die casting field was obtained while associated wth the die casting division of The Hoover Company.

METALS DISINTEGRATING NAMES PURCHASING AGENT

Appointment of Philip C. King as purchasing agent has been announced by Metals Disintegrating Co., Elizabeth, N. J., manufacturers of metal powders, metal pigments and metal abrasives.

Mr. King was formerly with General Aniline Works, Inc., as purchasing agent for engineering. He has also been purchasing agent for Condenser Service & Engineering Co., and for the Vanadium Corporation of America, and has been active in his own business, the Steel Trading Corporation.

REPRESENTS HITCHINER

Rex W. McMillan, formerly in charge of technical sales problems at the Milford, N. H., plant of Hitchiner Manufacturing Company, has been transferred to the West Hartford, Conn. sales office where he will handle sales of investment castings for the company. He will also handle sales of finished, machined parts of Hitchiner Products Corp.

Mr. McMillan has specialized, as a research metallurgist, with National Cash Register Co., in the development of investment casting methods and radiographic analysis of metals.

A. K. HIGGINS DIES

Arthur K. Higgins, an assistant director of research of Allis-Chalmers Manufacturing Company, Milwaukee, died November 6. He was 44.

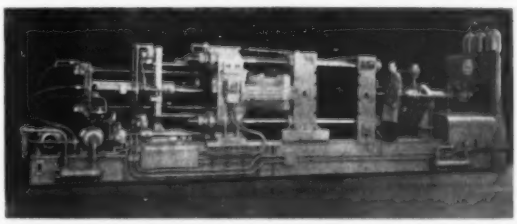
Higgins came to Allis-Chalmers in 1937 after four years with Globe-Union, Inc., Milwaukee. Previously he had been associated with the American Smelting & Refining Co.

IPM DOUBLES CAPACITY

M. T. Victor, president of the International Powder Metallurgy Company, located at 439 W. Main Street, Ridgway, Pennsylvania, has announced the completion of its expansion program. Mr. Victor says, "In order to keep pace with the terrific demand for sinterings, production facilities have been increased to double our output."

The company makes a variety of parts in a wide range of metals for the appliance, electronic, automotive, textile and metalworking industries.

LAKE ERIE BUILDS 1000-TON COLD CHAMBER DIE CASTING MACHINE



Recently demonstrated at the Buffalo, N. Y., plant of Lake Erie Engineering Company was a 1000-ton cold chamber die casting machine. A large number of commercial die casters visited the plant to witness the operation of the huge machine built specifically by Lake Erie for the Die Casting Division of Dow Chemical Company, Midland, Mich.

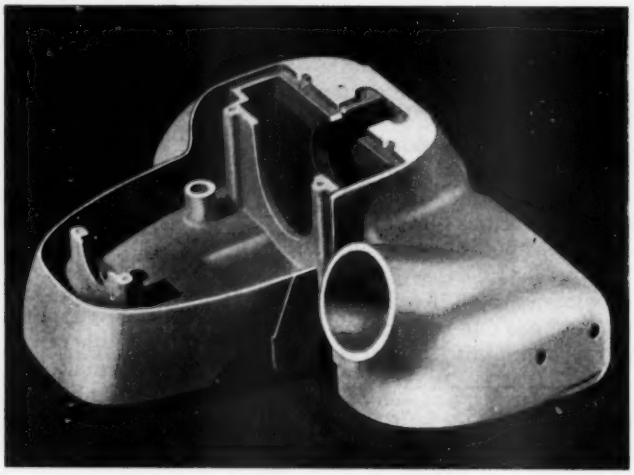
The machine is built on operating principles featured in the standard models manufactured by Lake Erie. This self-contained, heavy-duty die casting machine has 66″ x 66″ die plates, 40″ x 40″ between tie rods, and 12″ to 48″ die thickness.

It is complete with core pull valves and convenient distribution blocks, automatic lubricating system for toggle mechanism and hydraulic ejector. Inching and semi-automatic operation are accomplished by push button controls. Die opening and plunger stroke are adjustable.

STUDY GAS DIFFUSION THRU METAL FILM

Hanson-Van Winkle-Munning Co. Matawan, N. J., has announced the sponsorship of a graduate fellowship as part of its continuing long-range policy of promoting the study of fundamental research in electroplating and allied fields. Joseph M. Tobin is the new fellow, elected by the faculty at Michigan State College. He will study the "Diffusion Rates of Gases Through Metal Films."

Administration of the fellowship is under the direction of Dr. D. T. Ewing of Michigan State College. Russel H. Fay, recipient of the fellowship for the past three years, is now a teaching assistant in the College's Physical Chemistry Department.



Another type of Vacuum Cleaner Base produced by "Cleveland"

. . cast with many removable inserts

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OPPORTUNITIES

POWDERED METAL
CHIEF TOOL ENGINEER

Man capable of designing production tooling for large parts fabricating plant in East. Very substantial opportunity for right man. Send resume and picture to Precision Metal Molding, Box 1353. Our employees know of this ad.

SALES REPRESENTATIVES WANTED

Powdered metal parts sales agents for well known parts fabricating company. Many territories open. Write Precision Metal Molding, Box 1453. Our agents know of this ad.

FOR SALE: 5% chrome die casting die steel C .36, Mn .40, Si 1.1, Cr. 5.0, Mo 1.3, V .35 Due to discontinuation at 33c per lb. net. ROUNDS, SQUARES, FLATS, FORGING BILLETS. Write: Raven Steel & Tool Co., Inc., 525 Stagg St., Brooklyn 37, N. Y.

WANTED

Used Zinc or Cold Chamber Die Cast Machine in any condition. Give price, details and photo if possible in first letter. Box No. 1153 PRECISION METAL MOLDING.

NEW ENGLAND SALES AGENCY:
A leading agency covering the metal working field in New England desires an additional line of industrial parts. Preference: Die castings, permanent mold castings, plaster mold castings, powder metal or plastic parts. In addition to experienced sales engineers in the field, should have competent engineering department. Only a producer of quality parts will be considered. Box No. 1253 PRECISION METAL MOLDING.

SALES ENGRG. REP'N; NY. to DC: most comprehensive & effectual methods dev'l'd. & practiced by industry:- as unique to "salesmen" as Rube G. to electronics . . . & this is what it'll take to get &/or hold this new industrial center of the USA. Box 1553 Precision Metal Molding.

HELI-COIL EXTENDS STUDENT AWARD PROGRAM

Because of the widespread interest in the 1952 Heli-Coil Engineering Student Design Award Program and upon suggestions from interested educators and students, the Heli-Coil Corp. of Danbury, Conn.—manufacturer of helical wire screw thread inserts for the protection and repair of tapped threads in all materials—has extended the closing date of the competition from midnight December 31, 1952 to midnight March 15, 1953.

This award program is open to resident engineering undergraduate students registered in any school, college or university in the United States and Canada which offers a curriculum in any branch of engineering leading to a degree. Cadets registered in the United States Military Academy, Naval Academy and Coast Guard Academy are also eligible.

Cash awards will be made for the most original or unique new uses for Heli-Coil thread inserts as follows: first award, $1000; second award, $500; third award, $250; merit awards, $100. The number of merit awards will be determined by the contest judging board.

ALCAN OPENS L. A. OFFICE

To meet the growing need for aluminum ingot on the West Coast, the Aluminum Import Corp., United States sales distributor for Aluminum Company of Canada, Ltd., has opened a sales office in Los Angeles, according to Ward Van Alstyne, president.

New office at 510 West Sixth St., will be headed by Roy A. Gentles of Toronto. Aluminum Co. of Canada is a wholly-owned subsidiary of Aluminum Ltd., and has long been a supplier to the United States.

ALFRED M. JONES DIES

Alfred M. Jones, Midwest sales representative for Speer Carbon Co., International Graphite & Electrode Div., died Dec. 8, 1952. He had been with the company since 1934.

LETTERS TO THE EDITOR
continued from page 6

that can be anodized because recently we have made changes in the design of our product and are using anodized aluminum parts in a goldish color that we would like to match with the zinc die castings. It does not seem to be possible to match the same color as the anodizing by plating with brass or gold. We, therefore, require information as to whether or not it is possible to apply either electrolytically or in some other manner, an aluminum surface to the zinc die-castings which in turn can be anodized the same shade as the present trim we are using.—E.M.S.F.

Three suggestions have been forwarded, together with information concerning sources. These suggestions include: an-

here's how BIG INDUSTRIES SAVE on SMALL PARTS

PARTS FOR Electronics Products

PARTS FOR Toy Products

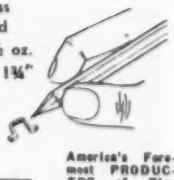
PARTS FOR Personal Products

PARTS FOR Electrical Products

GRIES DIE CASTINGS CAN SOLVE YOUR SMALL PARTS PROBLEMS TOO IN ONE OPERATION!

GRC zinc alloy die castings open extraordinary possibilities for new designs, products and economies, by producing the most intricate tiny parts in one high-speed operation. Gries offers fast delivery of 100,000 pieces to many millions on completely finished small parts. Write today for bulletin and samples—GRC may already have your problem solved or can solve it quickly and economically. Send prints for quotations.

Smallness Unlimited
Max. Wt. ½ oz.
Max. Lgth. 1¾"



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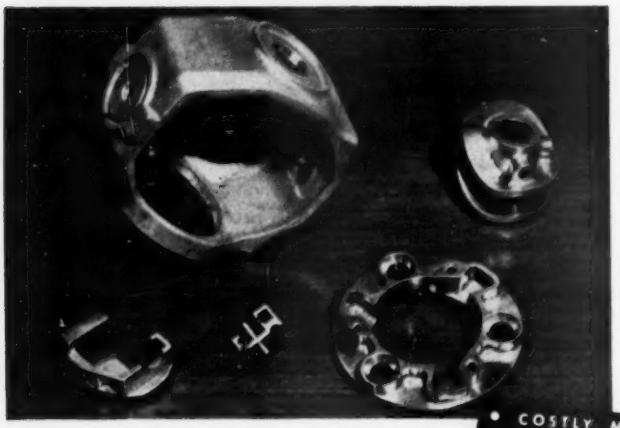

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PRECISION INVESTMENT CASTINGS

- cast centrifugally
- models and molds made by us
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- sample delivery three weeks from receipt of order

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Jackson-Walter Co. 2027 Arch St., Philadelphia, Pa.
Ralph L. Thompson Co. 77 South St., Stamford, Conn.

odizing the zinc die castings by means of the Anozinc process, applying an aluminum coating by spray metallizing, or applying an aluminum coating by vacuum metallizing.

By the first method, a proprietary treatment, it is possible to obtain an iridescent yellow, olive drab or black; by the second and third methods a thick, satin finish or a thin, bright finish respectively can be obtained.

It is doubtful that a close color match can be obtained, but by checking with each of the sources indicated, this can be substantiated.—Ed.

SHELL MOLDING
continued from page 30

conventional sand casting methods. It is possible to obtain excellent results provided the proper metal quality, chemical

When You Think of *Aluminum Ingot* THINK of S-G

The sign, S-G, on aluminum ingot means aluminum of uniform quality made to meet the most rigid chemical and physical specifications. Whether it's for permanent mold, sand or die cast you can be sure with S-G ingot.

Our complete modern research and testing laboratories are available to help you secure just the right ingot to meet your needs.

BRASS AND BRONZE INGOT ALSO PRODUCED TO YOUR SPECIFICATIONS

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die castings of highest quality produced on modern, fast equipment. Guaranteed satisfaction. Prompt service.

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Tell us your needs. Send blueprints or drawings for quotation. No obligation, of course.

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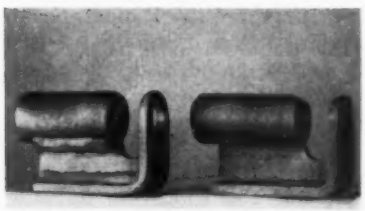
composition, and heat treatment are utilized. The reduction in sand erosion generally means cleaner metal. The testing of the heats of steel is usually conducted on specimens machined from the usual types of keel blocks in order to insure the complete soundness.

The shell molding process is capable of maintaining close dimensional tolerances and a high degree of detail. Accuracy to within .003 per inch is usually obtained in dimensions within each mold face. Tolerances across the joint of the mold halves are not as close but these measurements are held to within at least .009 per inch.

Sharp corners, piece marks, and other intricate detail can be well reproduced. The utilization of these closer dimensional limits and good detail can frequently be employed to appreciably reduce the cost of finish machining operations. The real opportunity to produce castings more economically lies in this saving of finishing costs.



12. FROM WELDING to shell molding: the low carbon steel bracket is now being made by shell molding as shown at right. Considerable saving is reported.

The cleaning room charges are less because of reduced sand erosion and adherence. The final machining operations can be considerably curtailed in many castings because of the improved detail and closer tolerances. The economic importance of these closer dimensions and detail varies, of course, with the tolerances required in the final product. This feature is frequently the deciding factor in selecting the shell molding method.

The smooth surface of the shell mold results in an improved casting surface over conventional sand molding. An excellent degree of smoothness can be readily attained in nonferrous and sand cast iron castings. The surface of steel castings poured in shell molds is acceptable but some improvements in present techniques are necessary to attain the same smoothness as cast iron. The smooth surface of the castings also reduces the finishing operations and facilitates preparation for plating and other surface finishes.

Comparison with other processes

The most promising field of the shell molding process appears to be in producing castings that have been made in

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Aluminum and Zinc Base

DIE CASTINGS

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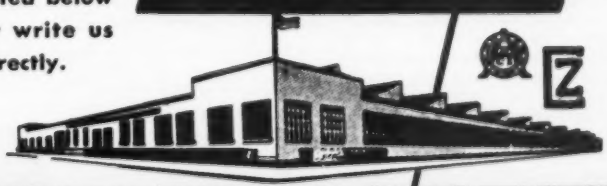
Consult any of the offices listed below or write us directly.



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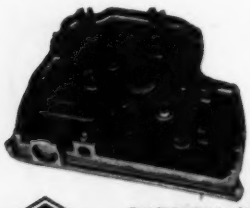
(NON—FERROUS)

PERMANENT MOLD, SAND, DIE CASTINGS

Our die casting division products require a minimum machining. Let our engineers solve your quantity production problems at attractive prices consistent with high quality.

FAMOUS PERKINS BRAILLER and some of the intricate parts die cast at HAMPDEN.



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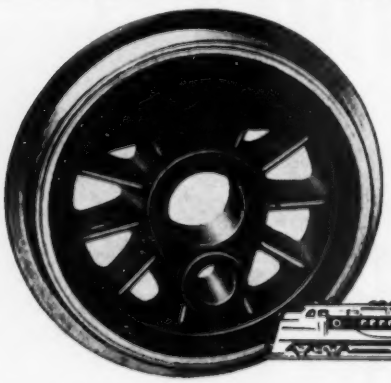

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sand by machine molding methods. The close dimensional tolerances and good surface that can be maintained, the excellent detail that can be produced and high metallurgical and mechanical quality usually attained makes the shell mold product an acceptable substitute for some other types of precision molded parts. An example of a low carbon steel bracket made by shell molding compared to the previously used welding fabrication method from bar and plate stock is shown in Figure 12. A considerable reduction in cost was accomplished by this change to shell molding.

The process is limited by several factors: (1) The high cost of machining a match plate necessitates a considerable volume requirement. (2) The match plate must be carefully designed and well produced by skilled tool or die makers if the castings are to be successfully manufactured. (3) The casting must be within the size range of the available equipment. (4) The part required must be so designed that it can be properly parted, gated, and fed to prevent shrinkage.

In addition to the high quality previously mentioned, the process has the following advantages:

1. A large expenditure of funds for the installation of the necessary equipment is not required unless an elaborate mechanization is planned.

2. The shell molds manufactured are reasonably strong and very stable; they can be stored indefinitely or transported to other pouring sites without damage.

3. Highly skilled labor is not required for any operation except design and manufacture of the match plate.

The final selection of shell molding over machine molding in sand will probably depend on

whether the reduction in finishing costs warrants the large initial cost of the match plate, since other processing costs are similar. Shell mold castings can be produced cheaper per unit than "lost wax" method castings, however, and *if parting, dimensions, and surface are satisfactory*, the choice of methods depends on whether the volume required justifies the additional cost of machining a match plate rather than a master pattern. Since large die costs are also encountered in the die casting, forging, and powder metal processes, the design of the piece, availability of equipment, and final quality are the determining factors.

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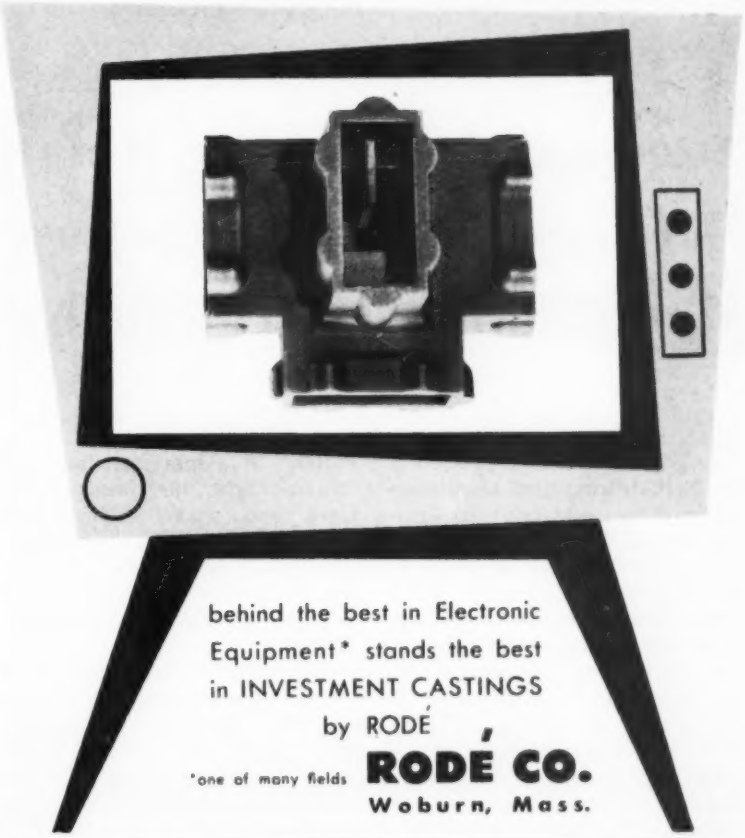

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Successful Working Relationship Between U. S. Die Casters and Manufacturers Praised by British

A 17-man team representing the British zinc and aluminum die casting industry has concluded that an important factor leading to high productivity of the American industry "was the apparent readiness of American managements, technicians and workers to try new method and their willingness to take risks commensurate with the rewards of success."

The British team's study tour was sponsored by the Economic Cooperation Administration (now the Mutual Security Agency) and the Anglo-American Council on Productivity. The report sets forth various conclusion and recommendations and states that the usefulness of the report will depend largely on the extent to which the British industry can increase its productivity by adopting the practices described in it.

U. S. Die Casting Output Is High

The report calls attention to the fact that "the output of both zinc and aluminum alloy die castings per head of the population in the U. S. is about 2½ times that in the U. K. There are several reasons for this, but the chief one is probably the *greater willingness of American manufacturers to adopt what is still a comparatively new process in order to simplify assembly problems and thus to reduce the cost of their finished products.*"

According to the report, the British team believes that "the ability of American industry to calculate its productivity level and make comparisons with previous years must greatly assist it in assessing the success or otherwise of measures designed to increase productivity."

The team had hoped to be able to make a direct statistical comparison between the productivity levels in the two countries. However, the report states that while several U. S. firms provided data for this purpose, the team found upon its return home that only a few firms of comparable size in the U. K. could provide similar figures. The team's conclusions on relative productivity were based therefore, on visual observation, stop-watch checks on cycle times, and on the personal knowledge and experience of individual members of the team.

With regard to another factor leading to high productivity in the American die casting industry, the British team's report says: "The impression was gained that *there was more cooperation between die casters and their customers in America than in the U. K. Customers, with the possible exception of the automobile industry, seemed readier to accept modifications to their designs where these would facilitate production and reduce the cost of a product.* There was less insistence on unnecessarily close dimensional limits or on an unduly high standard of finish for surfaces not visible in service."

The team offers 14 recommendations to the British zinc and aluminum die casting industry "in the hope that all concerned will give serious thought to the adoption of as many as are applicable to their own circumstances."

First among these is the recommendation that "consideration be given to the 'rehousing' claims of an industry which has quadrupled its capacity in little more than a decade and which is capable of reaching the highest levels of productivity." In this connection, the report states that, while many of the buildings housing die casting works in the U. K. are old, cramped and totally unsuitable for the purpose, there are fewer restrictions on capital investment in the U. S. and capital for new equipment appears to be more readily available in this country than in the U. K.

More Efficient Methods Are Recommended

Recommendations of a technical nature cover such steps as cooperation by manufacturers to limit the number of designs for components intended to fulfill similar functions and elimination of unnecessarily stringent requirements likely to increase cost or retard speed of production; careful and detailed planning of all aspects of production and handling prior to beginning a project; wider use of unit and nest die and of standard components in die construction; attaining and maintaining correct and uniform die temperatures by the provision of adequate waterways and over-

flow wells; careful review of existing plant layouts; improvements in work handling methods to reduce manual labor requirements and allow greater use of mechanical handling equipment; use of central melting furnaces and feeding of molten metal to holding pots of die casting machines; greater use of semi-automatic die casting machines and power trim presses, and improvements in inspection procedures to insure the early elimination of faulty castings.

In addition to the technical and mechanical improvements recommended, the British team's report deals at length with the cooperative between labor and management in the United States industry. In recommending to their own industry a greater delegation of authority and clearer definition of responsibility at all levels with responsibility to be adequately rewarded in terms of both status and pay, the members of the team point out:

"The high standard of living which exists in America appeared to be the direct result of the efficient conversion of abundant raw materials into salable articles. This required the full cooperation of effective management and willing workers.

"Management realized that, to obtain effective results from its workers, they must be given an interest in the firm and its activities. This idea is known as 'the principle of participation' . . . The team's observations led to the conclusion that the principle had become firmly established and was a reality."

foremen as compared with that of foremen in the U. K. was important. In the first place, worker had direct contact with the executive. Secondly, since foremen were invariably better paid than the workers in their department, even where piecerates were in operation, the best type of worker was attracted by the prospect of promotion. Thirdly, the position of foreman

continued next page

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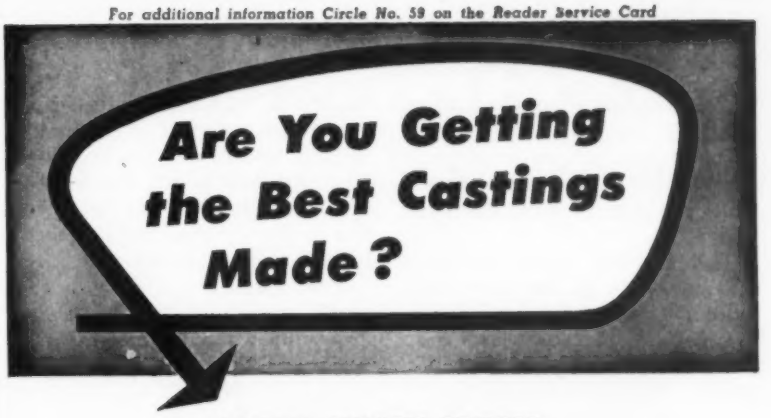

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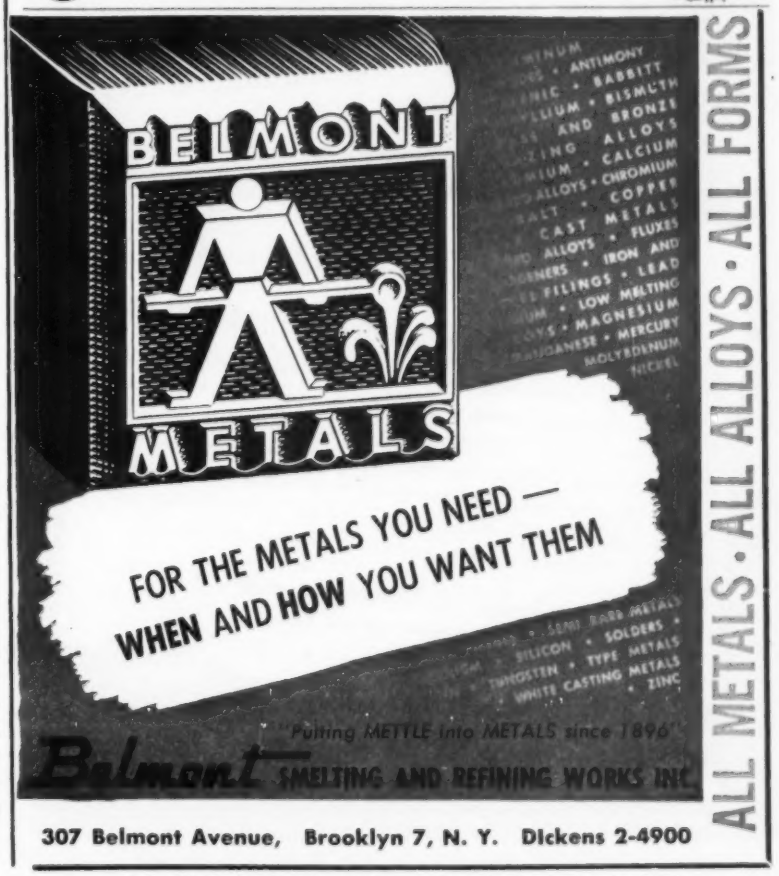
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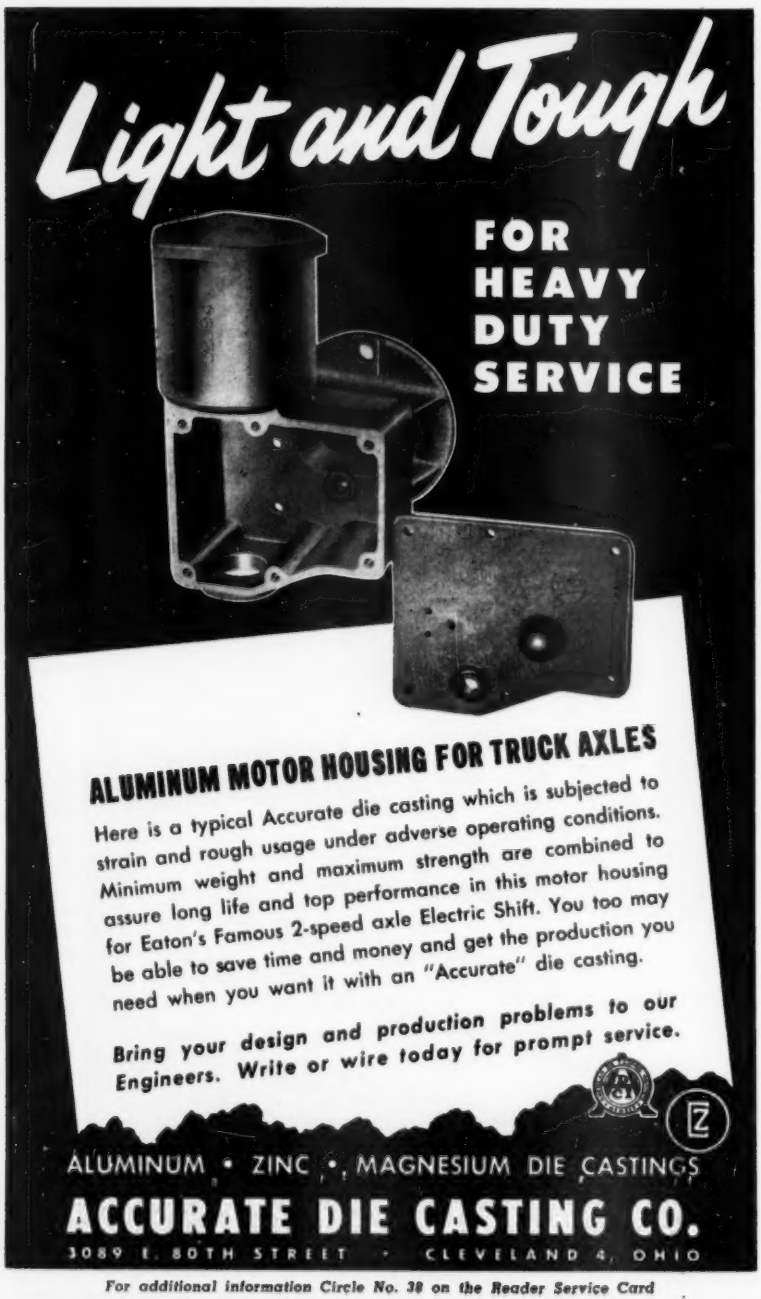
was a step on a ladder leading upwards to more important posts; it was not, as so often in the U. K., the summit of possible promotion from the shop floor."

The British team observed that workers in the American industry "appeared to have a completely different attitude towards profits from that frequently encountered in the U. K. They realized that a firm could not exist if it made no profits, and it was not regarded as unreasonable for the owners of a factory to be rewarded for the monetary risk and responsibilities they shouldered."

The plants visited on the study tour include: Ajax Engineering Corp., Trenton, N. J.; Ternstedt Div., General Motors Corp., Trenton, N. J.; Brown-Lipe-Chapin Div., General Motors Corp., Syracuse, N. Y.; Precision Castings Co., Inc., Fayetteville, N. Y., and Cleveland, Ohio; The Hoover Co., North Canton, Ohio; Lester-Phoenix, Inc., Cleveland, Ohio; Thompson Products, Inc., Cleveland, Ohio; Stewart Die Casting Div., Stewart-Warner Corp., Chicago, Ill.; Alumicast Corp., Chicago, Ill.; Doehler-Jarvis Corp., Toledo, Ohio; Hilfinger Corp., Toledo, Ohio and Dura Div., Detroit Harvester Corp., Toledo, Ohio; Gerity-Michigan Corp., Adrian, Mich. Mohawk Foundries Inc., Cleveland, Ohio; Schultz Die Casting Co., Toledo, Ohio; Eastern Castings Corp., Division of Eastern Malleable Iron Co. Newburg, N. Y., and Moldcast Corp., Newark, N. J.

Members of the British team were: C. R. Lyon (team leader), senior executive, Imperial Smelting Corporation Ltd.; E. C. Blamey, gravity die caster, Northern Aluminum Co., Ltd.; T. Bradshaw, toolroom foreman, Strebor Diecasting Co. Ltd.; J. C. Caudle, toolmaker, Perry Barr Metal Co. Ltd.; E. T. Cox, chief planner, W & T. Avery Ltd.; N. E. Judge, pressure die caster, Birmingham Aluminum Casting (1903) Co. Ltd.; J. T. G. Kidd, technical assistant to general manager, British Die Casting & Engineering Co. Ltd.; W. L. King, die designer, High Duty Alloys Ltd.; N. H. List, foundry superintendent, Northern Aluminum Co. Ltd.; L. A. J. Lodder, alloy investigator, Imperial Smelting Corporation Ltd.; J. F. A. Longstaff, toolroom section leader, Hoover Ltd.; T. A. Moger, foundry superintendent, Hoover Ltd.; H. E. Robinson (deputy team leader), foundry manager, Sterling Metals Ltd.; J. H. Smith, pressure die caster, AC-Sphinx Spark Plug Co. Ltd., and C. J. Williams, foundry superintendent, High Duty Alloys Ltd. The team secretaries were F. Carpenter, sales manager, Sterling Metals Ltd., and A. K. Parker, technical officer, Zinc Development Association.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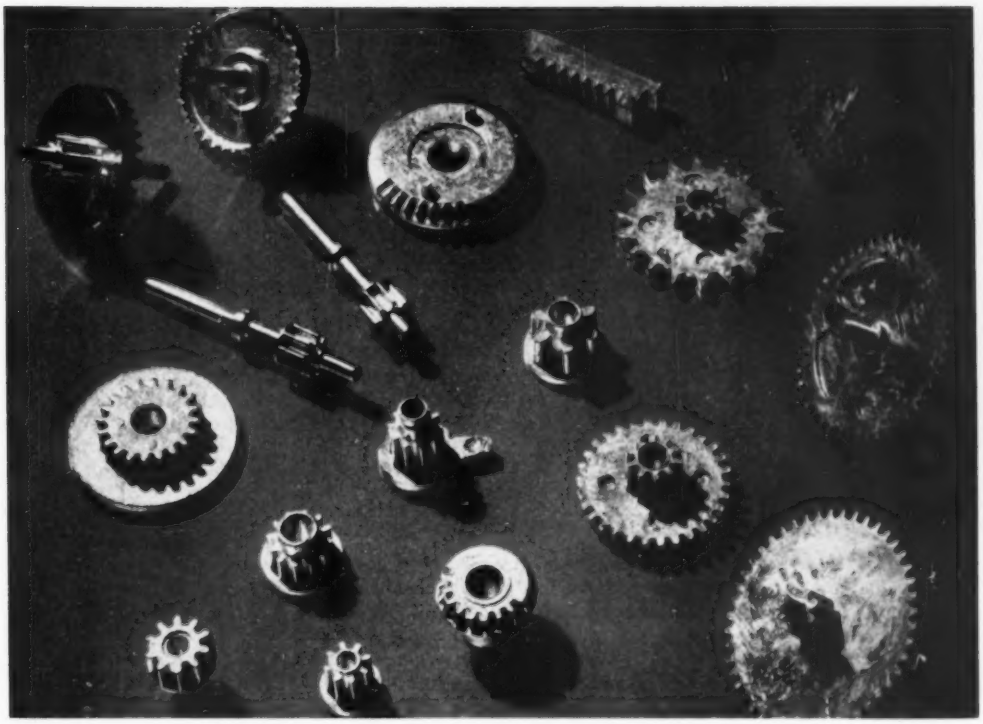


SMALL GEARS that can be die cast very often save the assembling of from two to four individual pieces, especially where a central shaft, hole, cam, hub, spacer, flange, etc. is required.

A representative group of tiny gears that are extremely economical as die castings is displayed above. All are products of Gries Reproducer Corp. of New York. Cost savings on such units are often large because these one-piece gears can be supplied ready to use, eliminating individual stamping, screw machine, assembling and other operations. Precision tolerances can be met in small gears of this type, but of course, where the need for accuracy is less, as in the manufacture of toys, the broader tolerances result in still lower costs.

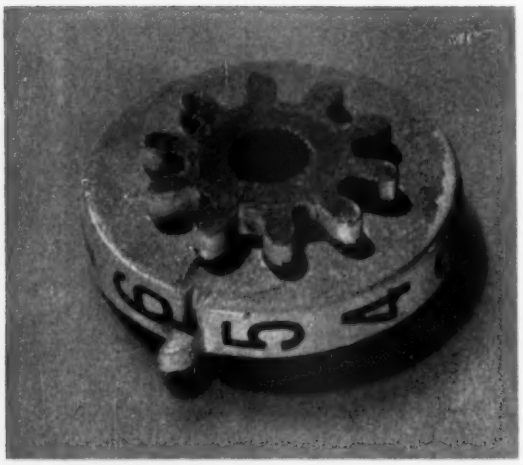
For the less precise applications, this die caster has developed a stock of interchangeable die-elements whereby any combination of available gear and pinion (or hub) dies can be made promptly without tooling charges.

Zinc alloy has reasonably good bearing properties which aid in quiet performance and also makes these die cast gears long-wearing where loads are moderate.

The gears, pinions and combinations illustrated are used in toys, timing devices, clock movements and various other mechanical applications.

SIMPLIFIED SOLUTIONS

for production problems



SUCCESSFUL IMPRINTING of numerals on the surface of an iron sintering suggests new applications for this type of part in business machines. Although the characteristic porosity of sinterings prevents successful painting in the untreated condition, this business machine counter has been sealed in such a way that a coat of white paint can be rolled on, followed by imprintiing with rubber roller.

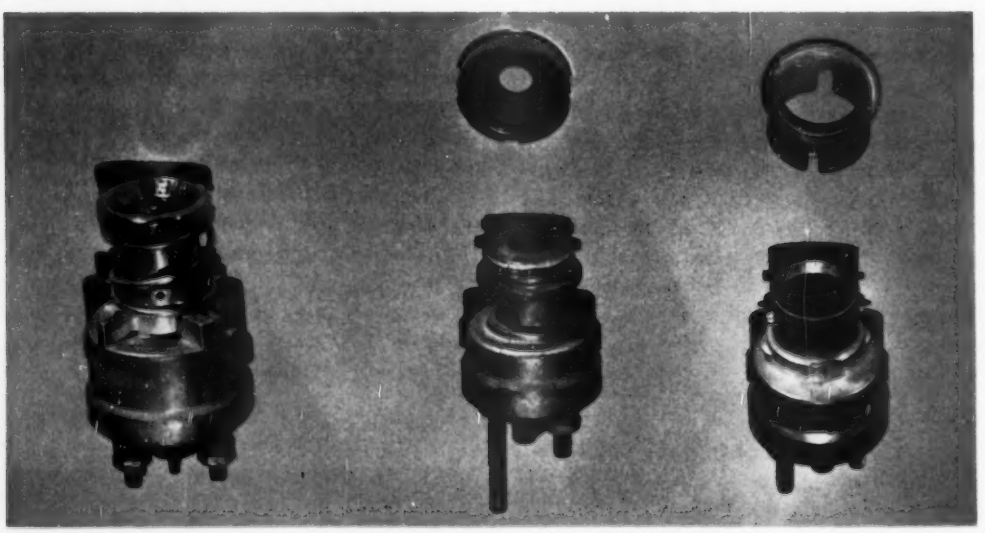
As a sintering, this piece is much less expensive than would be possible by conventional machining and assembling. While the part could be die cast in either zinc or aluminum, the specific service requirements here call for iron.

The part is produced by Dixon Sintalloy, Inc., of Stamford, Conn. Of particular interest, besides the painted periphery, is the small nib formed radially. A separate punch in the compacting press forms this portion so that density of the piece is uniform. The shouldered pinion is produced by powder metallurgy to have clean, accurate tooth forms and adequate physical properties.

TO SPEED UP ASSEMBLY and keep manufacturing costs down, the Sanborn Co. of Boston, Mass. utilizes a die cast zinc housing for its entire line of automobile ignition switches. Practically all automobiles and trucks use the same general type of ignition lock, varying only in the manner in which they are mounted on the dash board and minor differences in the shape of the lock barrel.

As cast by the L. E. Mason Co. of Boston, the lock housings accommodate almost any type of lock barrel the only change needed is to shift from one die core to another. Bezels are of only two types, either threaded or bayonet locks. The only machine operations that must be done on the barrels before assembly is to drill a small hole in the hole in the barrel housing to take a lock pin which holds the tumbler lock in place. The switch, mounted in a standard sized plastic block fits against a shoulder cast into the metal housing and is held in place by spinning the die casting over the edge of the plastic block.

Finishing is generally to chromium plate the bezel. No surface finish is applied to the housing proper.



DIE CAST OIL SEALS

continued from page 25

spacing, mounting and aligning members are designed into the castings so that assembly is the only step needed after the parts are delivered by the foundry.

In both of the castings in the foreground can be seen an annular groove. This groove is provided to hold the rubber membrane in place. When the seal is assembled on a jig, the rubber is fastened in place by simply rolling the edge of the groove so that it mechanically locks the rubber in the groove. As in the seal described above, there is no problem of making the joint between the casting and the rubber either pressure or vacuum tight; a good mechanical bond that will retain oil and grease is all that is needed.

continued next page

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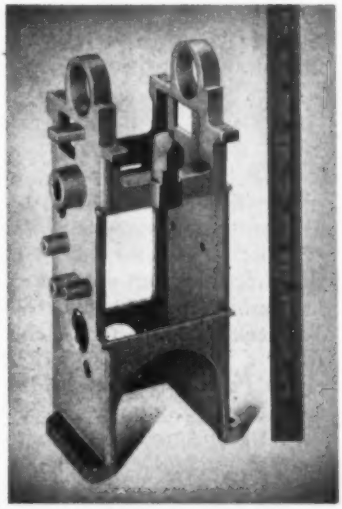

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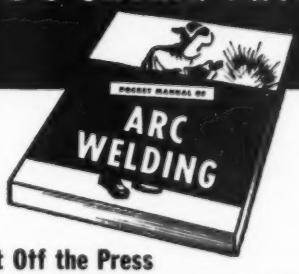

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The face of this seal has cemented on it a leather ring. To secure a good bond between the metal and the leather, the casting is given a chromate surface finishing treatment. The cement used is Epon cement developed by the Shell Oil Co. When properly applied, the bond is as strong as the leather and any attempt to remove it results in tearing of the leather rather than failure of the bond.

The castings used in the two seals described and some others used by Chicago Rawhide Mfg. Co. are made by Central Die Casting Co. of Chicago, Ill; Paragon Die Casting Co. of Chicago, Ill; Monarch Aluminum Mfg. Co. of Cleveland, Ohio; and Paramount Die Casting Co. of St. Joseph, Michigan.

CORRECTION

Attention is called to an error in credits connected with the article, "Electrodeposition is a production process," by Harold Rice appearing on page 42 of the December 1952 issue of PMM. The company with which Mr. Rice is associated is *GAR Precision Parts* of Stamford, Conn., specialists in contract electroforming and manufacturers of a line of hydraulic restrictors.

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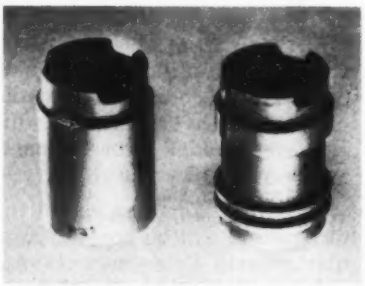
HOW WOULD YOU DO IT?

(see page 44)



The Solution: An iron sintering molded as a smooth part with one offset having the upper and lower ports molded in is made by the Metal Powder Products Co. of Dayton, Ohio (left hand piece in the illustration). Following sintering the cylinder is coined to give the desired OD and then machined with a form tool. Two cuts are taken, a roughing cut and a finishing cut. Using the lower ports as locating members the holes are then drilled with the piece mounted in an indexing jig.

Previously made by machining from bar stock, the use of a machined iron sintering has resulted in a decreased manufacturing cost of over 50 percent.

PRECISION CASTINGS OPENS PART OF NEW PLANT

Precision Castings Company, Inc. opened the first unit of its new die casting plant at Fayetteville, N. Y. at a house-warming event last month. Of the total projected area of 216,000 square feet of floor space 58,000 were put into service.

More than 3,000 visitors toured the plant, it is reported, examining the new and modern facilities. The plant is now in partial operation, but is expected to be working on a full production basis by Spring. Melting capacity will be about six times that of the old plant.

Among features of the new plant are alloying furnace equipment with capacities of 12,000 pounds of aluminum and 30,000 pounds of zinc.

PLANS SWISS FACTORY

Plans for the establishment of a branch factory at Lausanne, Switzerland, to supply spectrochemical equipment to European manufacturers have been announced by Applied Research Laboratories of Glendale, Calif.

Present plans call for a plant of approximately 3,000 square feet. More than 15 technicians will be employed, all of whom will be hired locally with the exception of the general manager. Material for the highly specialized testing equipment will be purchased in Europe wherever possible, ARL officials said, which will enable faster servicing of existing installations and expedite production. ARL's present staff of field engineers will service equipment now in use on the Continent, it was reported.

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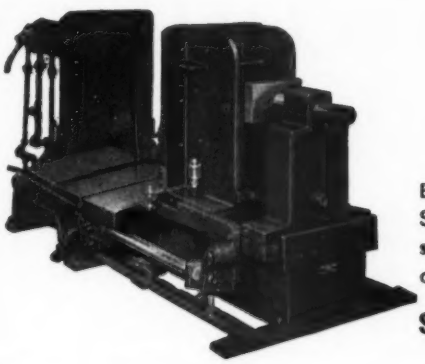

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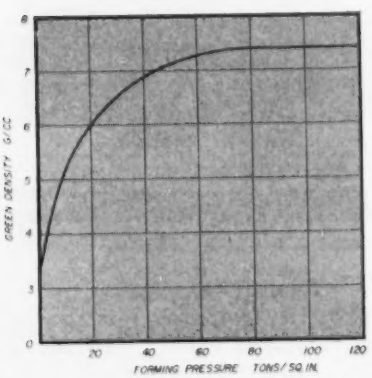
Compacting presses for POWDER METALLURGY

TO a very large extent, the type of part that can be made by powder metallurgical processes depends upon the pressing equipment available. Almost all other factors which define the end product can be varied within rather wide limits to give the final sintering* the desired properties. The press, however, is relatively inflexible so that any major change may necessitate a large capital investment for a new machine.

Functionally, the duties of the press are simple: to compress loose powder into a single mass, the green compact, having a uniform and controlled density. As the density of the compact is increased by the application of higher pressures, the green strength of the compact will also increase. This green strength will vary from a minimum which just allows the compact to be handled, to a maximum that closely approaches the density of wrought material of the same composition as that of the powder. The change in green density with pressure is shown graphically in Figure 1 where a typical pressure-density curve for Swedish sponge iron is shown.

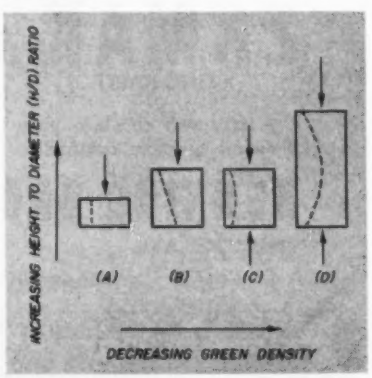
1. TYPICAL pressure-density curve for Swedish sponge iron.



It would appear from the curve in Figure 1 that any desired final density could be secured by selection of the proper forming pressure. Subsequent sintering would then give a compact with somewhat different final density (this depends upon both the time and temperature of sintering) but which would, in general, follow the green density curve. Unfortunately, however, most metal powders exhibit a critical unit pressure maximum. Below this critical pressure, the final density and contour of the sintering* is predictable and controllable; above the critical density, the final properties cannot be controlled.

To a degree, the lack of control above the critical green density is due to entrapped air which cannot escape through adequate interconnected pores. Before this trapped air can escape, the surface of the compact may be sealed by the sintering process. This will result in swelling of the compact due to expansion of the air. The effect of entrapped air can be minimized by slower application of pressure during compacting so that no large gas pockets remain in the green compact. Upon sinter-

2. EFFECT of number and movement of pressure-applying members.



*The word, sintering, is used in the place of the phrase, "a powdered metal part."

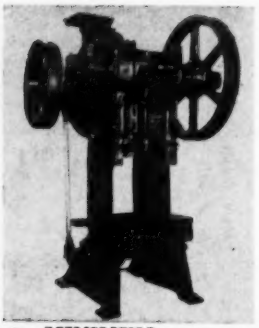
POWDER METAL COMPACTING PRESSES

MANUFACTURERS	Model Designation	Activation	Action	Maximum Pressure (tons)	Floor Space (inch)	No. Punches	Maximum Pieces Per Minute	Max. Dia. of Piece (inch)	Max. Depth of Fill (inch)	H. P. Required	Stationary Core Rod (2)
Baldwin	20	Mech.	Dpl. (4)	75	37 x 63	Variable	60 (1)	3	2¼	5	Opt.
Baldwin	45	Mech.	Double	200	66 x 91	Variable	60 (1)	4	3⅞	15	Opt.
Baldwin	50	Mech.	Double	100	60 x 120	Variable	30 (1)	4	6	20	Opt.
Bliss	25	Mech.	Double		Consult manufacturer for details.						
Bliss	Hydro-dynamic	Hyd.			Consult manufacturer for details.						
Colton	10-200	Hyd.	Double	200	53 x 52	One	15		10	45	S.E.
Colton	360	Mech.	Double	35	62 x 80	One	42	3	3	7½	S.E.
Dennison	Consult manufacturer for details.										
Elmes	Consult manufacturer for details.										
Kux	50 A	Mech.	Single	10	24 x 48	One	75	1½	1⅛	2	S.E.
Kux	50 B	Mech.	Double	10	24 x 48	One	75	1½	1⅛	2	S.E.
Kux	60 A	Mech.	Single	30	48 x 60	One	50	3	2¼	5	S.E.
Kux	60 B	Mech.	Double	30	48 x 60	One	50	3	2¼	5	S.E.
Kux	64	Mech.	Double	30	36 x 60	One	25	4	2¼	5	S.E.
Kux	64 S	Mech.	Double	30	36 x 60	One	25	1½	4¼	5	S.E.
Kux	74	Mech.	Double	50	48 x 72	One	15	6	6½	10	S.E.
Kux	74 S	Mech.	Double	50	48 x 72	One	15	3	8	10	S.E.
Kux	65 A	Mech.	Single	75	48 x 60	One	25	4	3	7½	S.E.
Kux	65 B	Mech.	Double	75	48 x 60	One	25	4	3¾	7½	S.E.
Kux	82	M&H*	Double	150	60 x 120	One	15	6	6	25	S.E.
Kux	4200	Hyd.	Double	200	84 x 130	One	10	10	8	40	S.E.
Kux	4500	Hyd.	Double	500	96 x 180	One	10	12	12	60	S.E.
Kux	25	Mech.	Double	15	36 x 48	6-25	1000	1⅛	1⅛	5	S.E.
Kux	1 C S	Mech.	Double	35	48 x 60	6-15	300	2¼	2¼	7½	S.E.
Kux	3 C S	Mech.	Double	50	48 x 72	6-15	300	4	4	15	S.E.
Lake Erie		Hyd.	Double	150	Consult manufacturer for details.						
Lake Erie		Hyd.	Double	200	Consult manufacturer for details.						
Lake Erie		Hyd.	Double	260	Consult manufacturer for details.						
Lake Erie		Hyd.	Double	350	Consult manufacturer for details.						
Lake Erie		Hyd.	S&A**	500	Consult manufacturer for details.						
Loomis	Uni-	Hyd.	Double	75	Consult manufacturer for details.						
Loomis	frame	Hyd.	Double	100	Consult manufacturer for details.						
Stokes	R	Mech.	Single	20	36 x 77	One	48	3	2	3	Opt.
Stokes	F-4	Mech.	Double	4	20 x 33	One	50	1¼	1¼	1	S.E.
Stokes	T-4	Mech.	Double	12	43 x 43	One	48	2	1⅝	2	S.E.
Stokes	R-4	Mech.	Double	20	51 x 70	One	45	3	2⅝	5	S.E.
Stokes	G-4	Mech.	Double	15	49 x 52	One	36	3	2¼	4	S.E.
Stokes	S-5	Mech.	Double	40	60 x 72	One	30	3	6¼	7½	S.E.
Stokes	244	Mech.	Double	85	60 x 96	One	25	4	6	15	S.E.
Stokes	294	Mech.	Double	60	35 x 73	One	55	4	2⅝	7½	S.E.
Stokes	280-G	Mech.	Double	100	65 x 93	One	24	4	4	15	S.E.
Stokes	720-A	Hyd.	Double	200	36 x 66	One	10	10	10	75	S.E.
Stokes	DD-2	Mech.	Double	15	52 x 74	23	680	1⅞	1⅜	7½	S.E.
Stokes	230	Mech.	Double	30	68 x 53	10	91	2½	4¼	20	S.E.
Stokes	210	Mech.	Double	100	80 x 73	6	48	6	5	30	S.E.

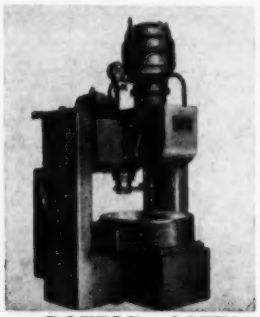
(1) This rate with single cavity die (2) S.E. — Standard equipment

(3) Opt. — Optional — consult manufacturer. *Mech. & Hyd. **Single & Angle

Note: See page 82 for additional data.

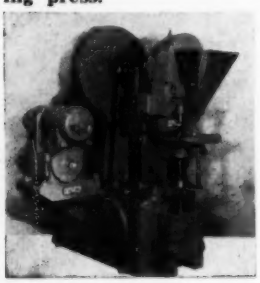


3. MINIMUM press requirements for compacting are represented by this conventional type of press.

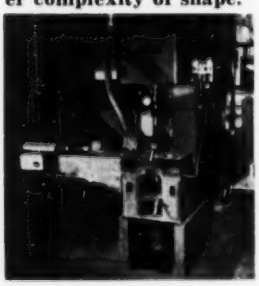


4. DOUBLE - ACTING presses are capable exerting pressure from both upper and lower rams.

5. EJECTION mechanism independent of lower ram is feature of this type of double acting press.



6. FLOATING CORE rods actuated by the lower ram permits greater complexity of shape.



ing, provided that the rate of heating is sufficiently slow, the residual air may be dissipated so that the final density and contour of the sintering is again controllable and predictable. This control of pressing cycle is, therefore, a second function of a powder press.

It was pointed out above that the green density of a compact is a function of the unit pressure applied during forming. What was said is a tacit assumption that the density throughout the compact is uniform. Actually, however, uniform density is achieved in only a few limited cases unless the forming press is sufficiently flexible to allow independently applied pressure from at least two directions. In addition, for maximum flexibility, the press must have a plurality of upper and lower rams so that near uniformity of density can be achieved even though the compact has a widely varying thickness in the direction of applied pressure.

How the density of a compact is affected by the number of and movement of the pressure applying members is shown schematically in Figure 2. As can be seen from this figure, if uniform density along the axis parallel to the direction of applied pressure is to be secured, a so-called double acting press is nearly always needed. Not shown in the illustration is the density variation that occurs when the compact thickness varies unless the press used is capable of a plurality of motions, each applied by a separate ram or punch.

The simplest press that can be used is one having a single ram working against a fixed platen. Such a press depends upon various devices built into the die for coring and ejection and is generally impractical for any except pilot work. Few presses of this type are used industrially except for cases where exceptionally high pressures are needed and where the amount of work for the press is limited. In that case, it is generally economically more sound to use a standard single acting press and spend more for dies rather than to build a special press of high capacity.

For practical production work, the minimum press that can be used is one having an upper working ram with an ejection device of some sort in

POWDER METAL COMPACTING PRESSES

Manufacturer	Model Designation	SECONDARY LOWER PUNCH				MOVABLE CORE ROD		
		Depth of Fill (inch)	Pressing Pressure (tons)	Supporting Pressure Locked (tons)	Stroke (inch)	Stripping Pressure (tons)	Supporting Pressure Locked (tons)	Secondary Upper Punch Pressure (tons)
Colton	10-200				6	11	100	
Kux	64	2¼	10	10	2¼	10	10	10
Kux	74	5½	20	20	5½	20	20	20
Stokes	G-4	2	5	12	2	5	12	5
Stokes	S-5	4	10	30	3	10	30	10
Stokes	244	6	40	70	4	15	40	40
Stokes	720-A	6	75	75	3	25	25	

the lower platen. A nolder for a fixed core rod is generally incorporated in such a press. Almost all press builders can supply this type of equipment, the No. 25, Bliss-Toledo press shown in Figure 3, is typical.

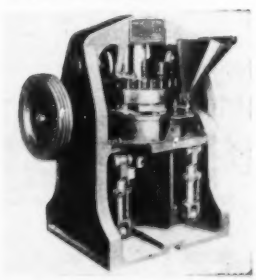
When the length of the piece being made is much greater than the diameter, it becomes necessary to use a press equipped with both upper and lower rams. These so-called double acting presses are capable of exerting equal pressure with either ram. The use of two rams minimizes density differentials along the axis of the part and except for very long pieces, may substantially eliminate it. As in the case of the single acting press, provision for a fixed core rod is generally incorporated and the lower ram further acts as the stripping mechanism. A typical press of this type is the Loomis Uniframe press shown in Figure 4.

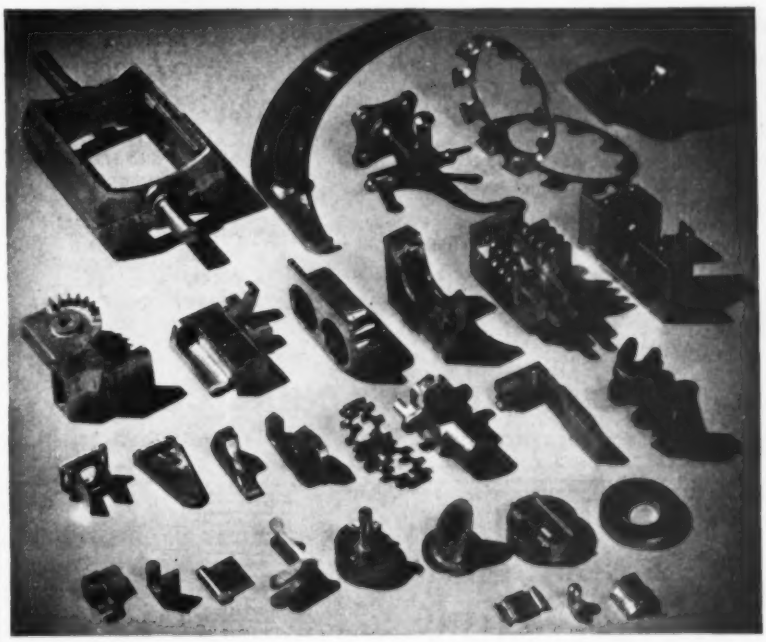
Where the part has variations in thickness such as flanges or stepped off-sets, a double acting press must be used and in general the ejection mechanism must be independent of the low ram action. Such a press allows the pressing of more complex shapes and has the advantage of floating core rods which may be actuated by the lower ram. This provides for more complex hole coring when necessary. The Colton Model 360 and the Dennison Multipress presses shown in Figures 5 and 6 are again typical presses of the type described.

As the complexity of the part being pressed increases, so must the actions of the press. Typical of the multi-motion presses available is the Model 244 Stokes press shown in Figure 7, having two upper and three lower plungers. Presses of this general type are always arranged so that the various plungers can be operated indi-

7. MULTI - MOTION presses such as this one may have more than one upper and lower punch.

8. ROTARY compacting presses may have as many as 30 sets of tools, thus multiplying machine output.





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vidually or in combination or can be locked in any predetermined position.

All of the presses described above are in the single punch category; i. e., they make one piece per cycle or per revolution. Where volume warrants, a multiple station press is often used. These presses have as many as thirty separate sets of tools and, per revolution, make one or two pieces per set of tools. Thus, for example, a sixteen station rotary press will make sixteen or thirty-two parts per revolution as contrasted with one part per revolution on the single punch machines. Tonnages are lower for this type of machine and press costs may be higher. One press of this general kind is the Model 25 Kux rotary machine, Figure 8.

Most of the presses used in powder metallurgy have a capacity of less than 150 tons total

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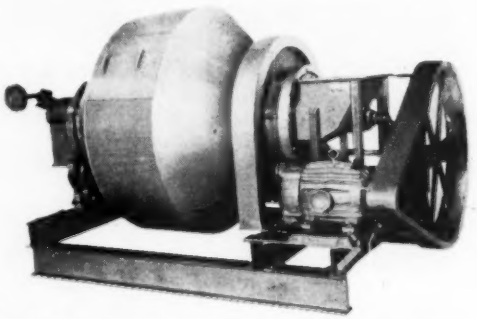

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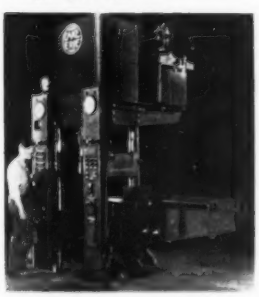
pressure. For some jobs, however, where the projected area is large; presses of several hundred tons capacity and in some cases over 1000 tons capacity must be used. Nearly all of these heavy presses are hydraulically operated. Generally they are tailored to the customers' requirements though in some cases a standard press may be used. Typical of presses of this class is the hydraulic press built by Lake Erie shown in Figure 9.

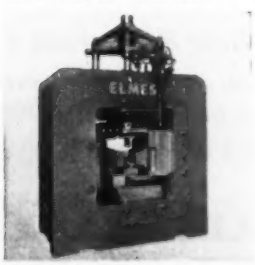
For special work where side pressure is required, a press of the type shown in Figure 10 is used. This Elmes unit is capable of exerting 1000 tons pressure from each of three directions, above, below and from one side. It should be noted, however, that such a press is highly specialized and little used.

The above is, necessarily, a very brief account of the presses being used by powder metallurgists. In Table 1 the details of many of the presses currently available are given. This table is not complete since, as noted, many of the presses in use are custom-built. All data given are taken from the manufacturers' publications.

9. HYDRAULIC presses with several hundred tons pressure are needed for compacting large pieces.



10. SIDE PRESSURE is sometimes needed for special work.



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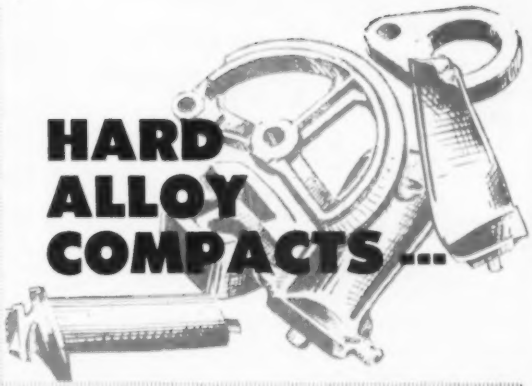

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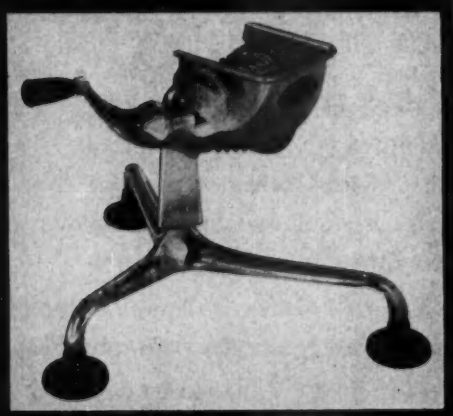

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"PIN-POINT" LUBRICATION
continued from page 27

either a sand casting or stamped from sheet steel. In the case of the sand casting, a considerable amount of secondary machining had to be done to ready the part for application of the hardened ring. In the case of the steel stamping, while machining was reduced, the oil reservoir had to be a separate piece fastened to the ring by soldering or brazing.

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